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Electricity Direct from Coal.

IN a country such as our own, which possesses practically no natural resources in the form of water power or oil, coal must of necessity be the chief source of electrical energy, at least until some method of obtaining electricity on a large scale fundamentally different from any so far practised such as, for example, the use of atomic energy, is devised. And yet the method at present employed, using the heat of coal to generate steam and then utilising this steam to drive a turbine which, in turn, drives an electrical generator, is extremely wasteful. The returns published by the Electricity Commissioners show that in the most efficient of our modern power stations barely 20 per cent. of the energy of the coal is converted into electrical energy, and even if the idea of using extra-high-pressure and high-temperature steam is carried to its limit, as is done in the Benson boiler, it is not expected that an overall efficiency of more than 35 per cent. will be obtained. It would appear, therefore, as though we must be content to accept a loss in converting the energy of coal into electricity of never less than 65 per cent., and under present conditions about 80 per cent.

It is always possible that some new process for obtaining electricity from coal will be discovered in which the steam engine, with its wasteful condensing plant, will be eliminated, and attention is drawn to such a process in an article by Ulick R. Evans, M.A., entitled "The Problem of the Fuel Cell—The Possibility of a Metallurgical Method for the Efficient Conversion of Fuel Energy to Electrical Energy," which appears in a recent issue of the Royal Technical College (Glasgow) Metallurgical Club *Journal*. The author, after reviewing the present uneconomical method of obtaining electricity from coal, draws attention to the attempts which are being made to devise a primary battery in which coal or some fuel derived from coal is made the negative, or consumable, electrode in much the same way as metallic zinc is employed at the present day. Every schoolboy who studies elementary physics knows that carbon takes its place in the electro-chemical series and that, in conjunction with some other substance, it can be utilised to form a voltaic, or primary, cell; indeed, carbon is used in the familiar Leclanché cell, although there it constitutes the positive, or unconsumable, electrode; but if such a cell could be perfected, there is no fundamental reason why an efficiency—fuel energy to electrical energy—of 95 per cent. should not be obtained. So far, how-

ever, as the author shows, little has been done to suggest that a commercial form of cell of large output can be devised, although results have been secured which indicate that electricity can actually be produced in this way direct from coal. Thus, Becquerel in 1855 claimed that a current could be obtained from a cell having carbon and platinum poles with fused nitre as the electrolyte, the carbon acting as the consumable pole. Taitelbaum in 1910 developed a cell originally introduced by Jacques in 1897, in which the cathode was of passive iron, and coal, lignite, or charcoal was the consumable element, while fused caustic soda containing sodium manganate formed the electrolyte. The great drawback of these cells is the effect of polarisation due to the sluggishness with which carbon enters into electrochemical reactions, which has the effect of reducing very considerably the e.m.f. as soon as the current is generated.

An alternative scheme is, however, available which, in the opinion of the author, represents a more profitable line of attack, and this is to follow along the lines of the Mond-Langer cell, in which two perforated sheets of blackened platinum were kept saturated with oxygen and hydrogen respectively, the poles being separated by a porous plate soaked in dilute sulphuric acid; the cell gave a current of 2 amperes at 0.73 volt, the energy efficiency being in the neighbourhood of 50 per cent. In recent developments of this idea the platinum has been replaced by less expensive metals and water gas, producer gas, or some other gaseous fuel has been substituted for the hydrogen. Thus, Baur and Ehrenbach in 1911 constructed a cell in which one pole was nickel saturated with hydrogen and the other fused silver saturated with oxygen, the electrolyte being fused borax. Similar cells were made to function with carbon monoxide, and it is suggested that the cell would function with such commercial fuels as water-gas. The author, in collaboration with Dr. E. K. Rideal, came to the conclusion that the only way to reduce polarisation was to devise what they term a "metallurgical fuel cell," in which a metal would be oxidised during the generation of current, but continually regenerated by the reducing action of the fuel.

About 1921 a cell of this type was developed in Switzerland by Baur, Treadwell, and Trümpler, in which the positive electrode consisted of magnetite granules (Fe_3O_4) and the negative of iron wire snippings, both packed in porous magnesia tubes embedded in a mass of loose magnesia, the electrolyte being a fused mixture of sodium and potassium carbonates. Oxygen and hydrogen were passed respectively through the positive and negative tubes so as to regenerate the electrode materials as quickly as they were used up. The e.m.f. of this cell was about one volt on balance, but the output was only of the order of 300 watts per cubic metre at a current density sufficient to reduce the e.m.f. to 90 per cent. of the balance value. It is suggested that this drop in voltage is due to high internal resistance rather than to true polarisation, and further, that water-gas or producer gas could be employed in place of hydrogen. It is apparent, however, that the dimensions of a battery of any commercial capacity would be excessive, but in this and in many other respects, no doubt the cell is capable of considerable improvement. In any case, the author concludes with the suggestion that research might be directed to this problem of producing a commercial form of metallurgical fuel cell using coal gas as fuel of such size and capacity that a battery of, say, ten cells could be utilised for charging accumulators. The practical experience thus gained would make it possible to decide whether there was reasonable hope of developing the system still further for use in the generation of power on a large scale. A valuable and comprehensive summary of the literature of the subject is given at the conclusion of the article, which should enable anyone who is interested to obtain full details of the work which has so far been accomplished and thus to discover any lines of research which it might be considered advisable to explore.

Electrical Refrigeration.

CONTRACTORS, wholesalers, and electrical retailers who have not so far considered it necessary to worry their heads regarding the subject of electrical refrigerators would do well to devote a little attention to it straight away. They should acquaint themselves generally with the advantages of electro-refrigeration both for domestic and for hotel, warehouse, and small shopkeeping purposes; should inform themselves regarding the importance imparted to the matter by reason of the new Food Regulations of the Ministry of Health which will come into force during 1927; and should familiarise themselves with the different makes of electro-refrigerator that have been already placed on the British market. Any preconceived notions that the matter is unimportant will fall away before a study of these points, because the climatic influence is greatly accentuated by reason of the new regulations regarding preservatives in food. Our hot weather spells are of such brief duration that we hardly begin to accommodate ourselves to a cooled dietary and the use of fans before we have to switch on the radiators. Ice merchants cannot lay themselves out with confidence to do a lasting business on any great scale for that reason, except with hotels, butchers, fish and provision shops and such like places where food must be kept cool in order to avoid waste.

But the food regulations which will limit the use of chemical preservatives will necessitate the use of refrigerators far more extensively than have the normal effects of hot weather. The enormous waste of foodstuff which "goes bad" at the shops adds materially to the selling cost of that which reaches the public, and the cost of living is thus increased. Shopkeepers who are wise and wish to stand well with their customers advertise their possession of ice safes in the hot weather, but foods which have been in the habit of having their useful "life" lengthened by the use of preservatives will now have to succumb and be burned on Monday morning in the public incinerator if steps are not taken to preserve them by refrigeration processes. The demand for electric refrigerators ought therefore to increase substantially. Indeed, anybody who is in close touch with developments knows that it is doing so already. The progress of the last two or three years has been on such a scale as to surprise the sceptical, and it bids fair to grow rapidly. Several makes have been placed on this market during the last few years, and no doubt more will follow. We may be a little reluctant in comparing the possibilities in this country with achievements in the United States, where there are said to be 600,000 domestic electric refrigerators in use, but the recent activity here has given a considerable boost to sales and a rapid advance is anticipated during the next few years. The electric washing machine is selling here unobtrusively by its thousands per annum, but it has not the advantage of any new regulations regarding clothes washing to assist it. The Press publicity that the electric refrigerator will receive, backed up by necessity imposed by the aforesaid Regulations, will prepare the ground for electrical contractors and traders, all of whom we advise to equip themselves with information on the subject generally and with details of the available refrigerators.

The L.C.C. Tramways' Recovery.

THOSE who maintain (as we do) that the tramway is not yet out of date as a means of transport in well-populated areas will derive a certain amount of satisfaction from the L.C.C. Highways Committee's report for 1925-26. This shows that the net deficit on the working of the tramways was less than half that incurred in the preceding year and less than the deficit of 1923-24. It has to be confessed that relief to the extent of about £300,000 was gained by the suspension of certain debt repayment instalments, but this was also the case in 1924-25, and so the comparison holds good.

At the risk of being held guilty of monotonous insistence we again say that the deficit is merely a "paper"

one. Apart from the iniquitous charges which all tramways have to bear—the worst of which is the maintenance of roadway worn out by other transport, which is often competitive—a municipal system is obliged to meet interest and repayment charges from which private concerns are free. This is not to say that the repayment of money borrowed during the life of the assets purchased with it is a bad system; it is the soundest of finance.

Therefore, in considering the deficit of £114,629, it is only just to take account of some of the heavy charges which have produced it, without, however, causing any real financial loss to the public which owns the tramways. One item alone, the estimated saving to the road authorities consequent upon the tramways' obligation to maintain the roadway, amounted last year to £235,000—twice the amount of the deficit; rates on the permanent way absorbed £60,822; and street widening contributions amounted to £30,456.

The Committee has had under consideration a number of proposals for improving the system and increasing facilities, but finds itself unable to adopt most of them. It is, however, improving the interior arrangements of a number of the cars, and better lighting is one important feature of this improvement.

Electricity Supply Policy.

In an address broadcast from station WRNY last month, Mr. Arthur Williams, a vice-president of the New York Edison Company, explained why the great Edison power stations—even the most recent—were situated within the city limits, instead of being built near the coal mines. He pointed out that the outstanding responsibility resting upon his company was to provide the citizens with "absolutely continuous, unlimited electrical service"—a consideration more important than that of cost, in view of the complete dependence of the city upon electricity supply for innumerable essential purposes. Long-distance transmission, he said, was not sufficiently free from the risk of interruption to permit of operation without local steam stand-by stations in the city; moreover, the immense quantities of water required for condensing purposes were not available on the coal fields, and it was not safe to rely upon a single group of mines for the continuous supply of coal—the company had had to import coal from abroad several times during past years, in order to protect the city's electrical service.

In this country, on the other hand, we are confidently assured, on the basis of American practice, that by the use of interconnecting main transmission lines the degree of reliability attainable is so great that stand-by plant can be reduced to the order of 10 per cent. Which are we to believe—New York or Chicago? There can be no doubt as to the correct reply; it is quite clear that the shorter and more direct the connection between the power station and the load, the less is the liability to interruption. That is the policy adopted in New York, and it is justified on other grounds; for instance, unless a high load factor is obtained, it is unquestionably cheaper to carry coal than to transmit electricity over a long distance—and in many cases the last four words could be omitted without invalidating the statement. In the discussion at Loughborough on Mr. A. B. Mallinson's paper on "Justifiable Small Power Plants," printed in the July issue of the I.E.E. *Journal*, Mr. W. Pearson stated the case for local power stations of medium size convincingly. He said that the claims put forward on behalf of super-stations supplying wide areas were based on three assumed advantages: Higher efficiency, lower capital cost, and better diversity factor. The last, as we have pointed out, is fallacious, and no evidence in support of it has been forthcoming up to the present. Mr. Pearson cites instances showing that the load factor obtained does not depend on the size of the plant, and that the coal costs at Manchester, Glasgow, and Birmingham are no less, but even greater, than those at Rotherham, Walsall, and St. Helens, whilst the total working costs of the three big undertakings stand 22nd. 35th, and 43rd in the list, respectively, and the average prices charged by them are far above those of some quite small stations. The same applies to the capital cost per kW installed—a most important consideration, with the load factors prevalent in this country. If, says Mr. Pearson, the large modern station cannot supply near-by consumers more cheaply than the modern medium-sized station, how can it be expected to supply at a distance more cheaply than the local medium-sized station? In point of fact, it cannot do so, and the Electricity Commissioners have actually had to sanction the installation of modern plant in small stations because the cost of transmission over a moderate distance has put bulk supply out of the running.

Yet the national electricity scheme essentially depends upon transmission as opposed to local generation!

A Congress of Chemists.

The advocates of a comprehensive convention embracing all electrical interests may derive courage and inspiration from the example which has been set them by the Society of Chemical Industry and kindred associations. At the last annual meeting it was decided to meet in London this year, and arrangements were made to secure the co-operation of other societies more or less closely allied with the chemical industries in making the occasion an opportunity for all persons engaged in chemistry to come together. No fewer than sixteen scientific and technical associations, in addition to the Society itself, are taking part in this notable meeting, which is without precedent in the history of the chemical industry. In his presidential address, commenting on this event, Mr. W. J. U. Woolcock, C.B.E., expressed a wish for the co-operation of another body of men—the electrical engineers—particularly in connection with the fuel policy of the Society, a wish which no doubt will receive sympathetic consideration, for there is much in common between the two industries.

The Congress commenced on Monday last, when the Messel Memorial Medal was presented to Earl Balfour, and on the same day an exhibition of chemical plant was opened in Westminster. The exceptionally comprehensive character and imposing numbers of the Congress will attract public attention to its proceedings, and impress upon the nation the importance of the great industries which it represents, whilst the members of the various bodies concerned cannot fail to derive much benefit from the unique opportunities it affords for meeting one another and exchanging views.

We see no reason why the electrical industries should not score an even greater success, for they have a larger field to draw upon, and their subject appeals more directly to the general public; moreover, the value of a great electrical convention for propaganda purposes would be vastly greater than that of a chemical congress. We trust that the idea will germinate and come to fruition, and that the example of the chemical men will be borne in mind.

Pulverised Coke for Firing Boilers.

One of the most weighty questions in connection with the development of low-temperature carbonisation is the disposal of the "semi-coke" which results from the process. We have drawn attention to the McEwen system, which produces coke in powder form, suitable for firing boilers, but what can be done with solid semi-coke, of which enormous quantities may eventually become available under other processes?

An interesting attempt to solve this question was recently reported in the *Iron and Coal Trades Review;* experiments were carried out with plant erected by Messrs. Clarke, Chapman & Co., Ltd., of Gateshead-on-Tyne, for the purpose of demonstrating pulverised-fuel firing on a large scale. From the raw duff coal 19 gallons of oil per ton were obtained, and the gas evolved (of 485 B.th.u.) amounted to 11.7 per cent. of the weight of the coal, whilst 72.5 per cent. remained as solid fuel. The coke was pulverised and fed to a boiler, which produced 9.2 lb. of steam per lb. of fuel, with a thermal efficiency of 83.5 per cent. This is said to be the first occasion on which such a test has been carried out on a commercial scale, and the result is highly satisfactory.

Minor Aerial Power Lines.

Some Notes on their Design and Construction.

By R. GRIERSON.

(*Continued from page* 91.)

9.—Stay Wire Details.

It is not always an economical proposition to provide poles strong enough to stand up to all the stresses to which they are subjected, particularly at angles and terminals. Stays or struts are therefore frequently used, and the details connected with stays will now be briefly considered.

In order to secure the maximum advantage of a stay the upper end should be fixed as near as possible to the point of the resultant pull of the aerial lines, fig. 5; the angle that the stay makes with the pole should be as

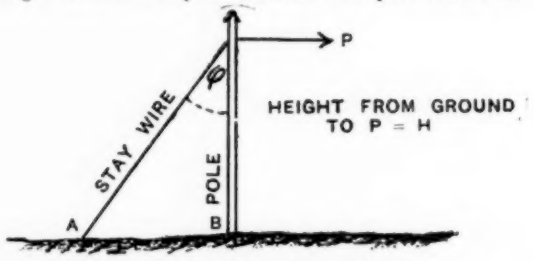

Fig. 5.—Fixing of Stay Wire.

large as possible, the lower end should be securely fixed, and provision should be made for adjusting the length of the stay wire after the ends are made off.

Although stay wire is commonly referred to as galvanised iron, B.E.S.A. Specifications Nos. 174 to 184—1923 state that "the wire shall be of mild steel containing approximately 0.2 per cent. of combined carbon,

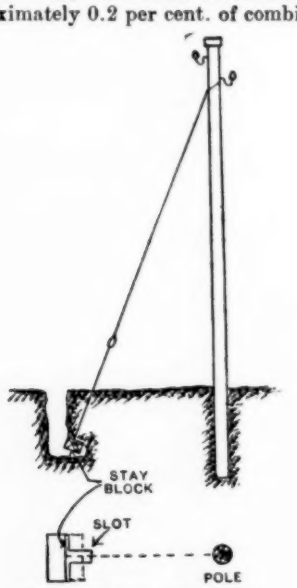

Fig. 6.—Details of Stay Block.

and shall be galvanised with virgin spelter." The size of the wires forming the "cable" is commonly No. 8 S.W.G., and the number of wires either 4, 5 or 7. Details are as follow:—

Size.	Weight. lb./mile.	Min. breaking strength (lb.)	Approx. overall diam. (in.)
4/8	1,400	5,600	$\frac{3}{8}$
5/8	1,750	7,000	$\frac{3}{8}$
7/8	2,450	9,800	$\frac{1}{2}$

A factor of safety of 2 is frequently allowed, *i.e.*, the stay wire should have a breaking strength of at least twice the maximum stress in it.

To enable the length of the stay wire to be adjusted, the lower end is made off to a stay rod and tightener. Standard lengths of stay rod are 6, 8 and 9 ft., the lower end of the rod being fitted with a square iron plate of suitable dimensions.

The average breaking strength of stay rods is given by authorities as follows:—

Diam. of rod (in.) ...	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1
Breaking weight (lb.)	10,650	15,900	21,900	29,100

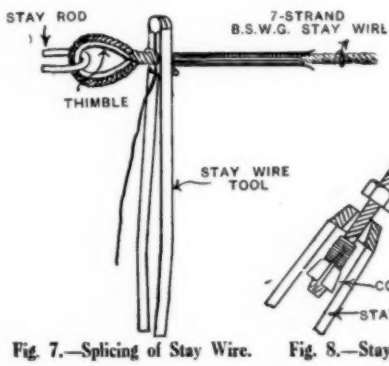

Fig. 7.—Splicing of Stay Wire.

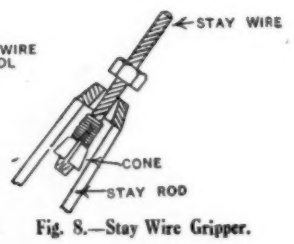

Fig. 8.—Stay Wire Gripper.

The maximum pull on the stay wire should not exceed 50 per cent. of the breaking weight. To secure a good anchorage for the stay rod in ordinary ground a stay block, or "dead man," is buried to a depth of from 4 to 6 ft. A useful size is 3 ft. 6 in. × 10 in. × 5 in., for which the breaking load is stated to be from 12,000 to 25,000 lb. The Helsby Company states that the weight of earth which a stay block would tend to lift, when being uprooted (assuming loam to have a natural angle of repose of 30 deg.) would be 6,940 lb. for a depth of 4 ft. and 18,000 lb. for a depth of 6 ft. It further states that a sufficient factor of safety is provided by the friction of the general body of the earth and by the

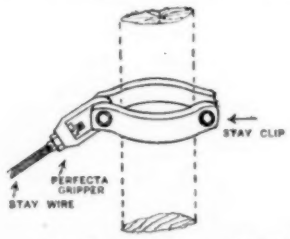

Fig. 9.—Stay Clip.

Fig. 10.—Globe-Strain Insulator.

fact that a natural angle of 30 deg. with the vertical is too small.

Care must be taken, in excavating the hole for the stay block, to disturb the soil as little as possible, and the hole should be undercut, fig. 6, so that it may have the firm earth to resist the upward pull.

The standard method hitherto employed to attach the stranded stay wire to the pole and to the stay tightener has been by means of splicing, fig. 7, but this is liable to prove very costly with 7/8 S.W.G. wire; particularly if the men employed are not used to the work. In the job referred to special stay clips or collars and grippers were used for the pole end, and special stay rods for the ground end. The clips, fig. 9, simply consist of a galvanised wrought-iron collar, formed in two halves and bolted together round the pole, the gripper being held by the bolt. The stay wire is held in the gripper by a split conical nut of special form, fig. 8, and this fits into a coned hole. The stay wire is very firmly gripped, and the galvanising is not disturbed. The Regulations require insulators to be

fixed in all stay wires, supporting power lines, at a minimum height of 10 ft. above ground level. These can be obtained in various forms, figs. 10 and 11, but in ordering, consideration should be given to the method of attaching the stay wires, and also to the breaking and safe load. Several manufacturers are curiously

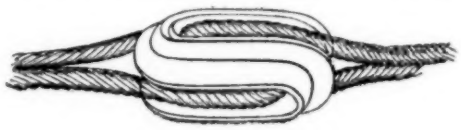

Fig. 11.—Egg-Type Insulator.

reticent on the latter point in their printed lists. Fig. 13 shows a mechanical clip for making off the stay wire.

10.—Stress on Main Terminal Poles.

The total horizontal pull on the lighting wires for the line under consideration will be $1,389 \times 2$ (see par. 3), plus the pull of the two telephone wires.

It was stated in par. 3 that for equal sag or dip, the pull is proportional to the load, and the weights of the lighting and 'phone wires have already been stated to be 1,015 and 150 lb./mile respectively. The pull on each 'phone wire is, for equal dip—

$$1,389 \times 150/1,015 = 205 \text{ lb.}$$

The total pull will be:—

Lighting wires	$1,389 \times 2 = 2,778$
'Phone wires	$205 \times 2 = 410$
	3,188

or, say, 3,200 lb. approx.

The feed to and the lead in from the extreme terminal poles is by means of underground cable across the ornamental gardens, and as the line is in a very exposed position, the writer's experience in France indicated that choke coils and earthing resistances were not only desirable but essential for safe operation during

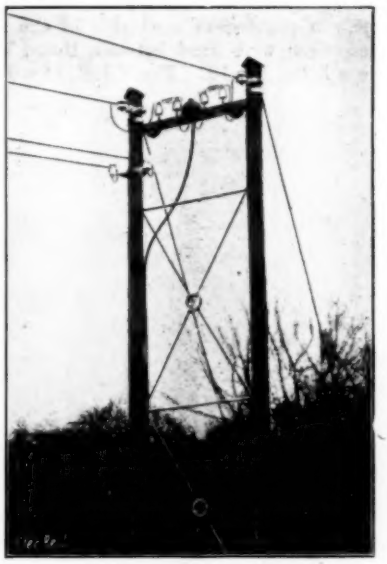

Fig. 12.—Terminal "H" Pole.

the prevalence of thunderstorms. An "H" pole type of construction, fig. 12, was therefore decided upon in order to avoid crowding the gear, and one lighting and one 'phone line is connected to each. Under these circumstances the horizontal pull on each of the poles is—

One lighting wire	...	1,389 lb.
One 'phone wire ...	...	205 lb.
Total pull per pole ...		1,594 lb.

In this case the stay could be fixed directly under the insulator carrying the No. 3 S.W.G. conductor, so that the resultant was regarded as equal to 1,600 lb.

The stress in the stay wire, fig. 14, clearly depends upon the angle that the stay wire makes with the pole, ϕ.

The stress in the stay wire $= S = P/\sin \phi = 1,594/\sin \phi$.

The distance A B, *i.e.*, from pole to stay wire at ground level $= H \tan \phi = 24 \tan \phi$.

The distance A_1 B_1, *i.e.*, from pole to stay block C, at a depth of 6 ft. 0 in. $= H \tan \phi = 29 \tan \phi$.

ϕ deg.	Sin ϕ.	Stress in stay wire (lb.)	Tan ϕ.	Pole to Stay Wire. Ground level 24 tan ϕ (feet).	Pole to Stay Wire. 5' below ground level 29 tan ϕ (feet).
5	0·057	18,200	0·08	·92	2·32
10	0·173	9,200	0·176	4·2	5·1
15	0·258	6,150	0·267	6·4	7·75
20	0·342	4,650	0·342	8·2	9·90
25	0·422	3,760	0·466	11·2	13·6
30	0·500	3,180	0·577	13·8	16·6
35	0·573	2,770	0·700	16·8	20·3
40	0·642	2,470	0·839	20·0	24·2
45	0·707	2,250	1·000	24·0	29·0

Wherever possible, it is more convenient to use only one stay wire to each pole, in which case the angle of the stay is fixed by reference to two factors, *viz.*—the space conveniently available between the pole and the stay and the strength of the stay wire, stay rods and stay block.

It will be seen, therefore, from the previous Table, that if a minimum distance of 8 ft. 3 in. can be obtained between the point at which the stay wire enters the ground and the pole, the pull is approximately 4,650 lb., which calls for 7/8 S.W.G. stay wire and a $\frac{5}{8}$-in. stay rod, with the stay block buried 6 ft. deep. Clearly it is

Fig. 13.—Making-off Clip.

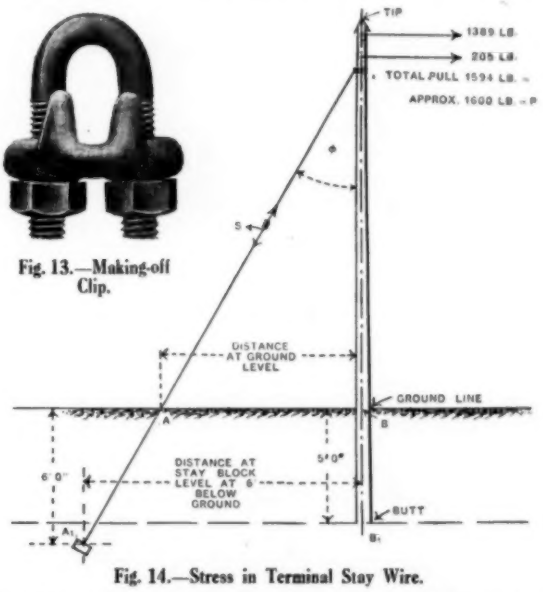

Fig. 14.—Stress in Terminal Stay Wire.

desirable to increase the space as much as possible, but usually farmers object to anything greater than 13 to 14 ft.

11.—Stress at Corner Pole.

At one point the direction of the line wires changed, the angle θ formed between them being approximately 140 deg., fig. 16.

To prevent the pole being pulled over, a stay is obviously necessary, and the horizontal pull required to counter the pull of the line wires can be obtained from the following useful table extracted from the Helsby list above mentioned:—

$S = PK$, when K is

θ ...	175	170	160	150	140	135	130	120	110	100	90
K ...	0·086	0·174	0·348	0·518	0·684	0·766	0·846	1·00	1·148	1·286	1·414

The total pull for the four wires has been shown to be 3,200 lb., and the horizontal pull required to counterbalance these, where $\theta = 140$ deg., is—

$$0.684 \times 3,200 = 2,188 \text{ lb.}$$

Assuming that the stay makes an angle of 30 deg. with the pole, the stress on the stay, as already shown, will be—$S = P/\sin \phi = 2,188/0.500 = 4,376$ lb., fig. 15.

This is just slightly less than half the breaking load of 7/8 S.W.G. stay wire, which was therefore used, together with a $\frac{5}{8}$-in. stay rod and a 4 ft. × 8 in. × 4 in. stay block buried 6 ft. deep.

12.—Stress on Intermediate Terminal Poles.

In order to localise the damage to one or two bays, in the event of a line being shot down, the purchaser desired the wires to be definitely terminated at several points in the run, and longitudinal stays were therefore necessary for these poles.

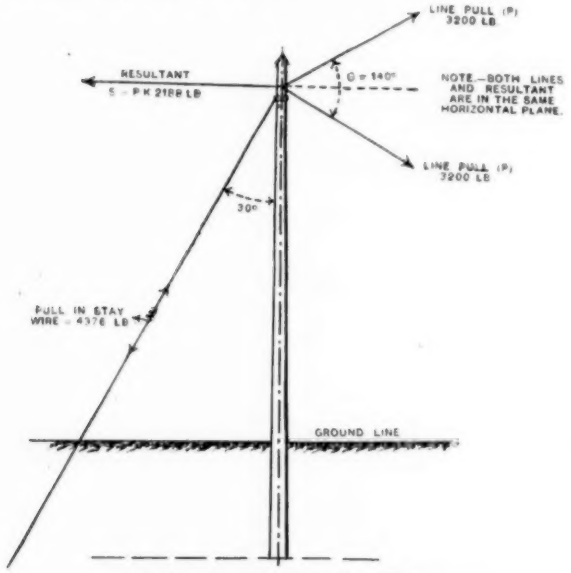
LINE PULL (P) 3200 LB
RESULTANT
S = P K 2188 LB
θ = 140°
NOTE.—BOTH LINES AND RESULTANT ARE IN THE SAME HORIZONTAL PLANE.
LINE PULL (P) 3200 LB
30°
PULL IN STAY WIRE = 4376 LB
GROUND LINE

Fig. 15.—Stress in Corner Stay Wire.

It is scarcely conceivable that more than one line could be cut through by a chance shot, and one line only was provided for in designing these stays, *i.e.*, a maximum out-of-balance pull of 1,400 lb.

Due to the fact that shackle insulators were used, fixed vertically one above the other, the stays could not be fixed between the two heavy lighting wires, but had to be attached to the pole a little lower down. Assuming the two pulls of 1,400 lb. could be replaced by one acting

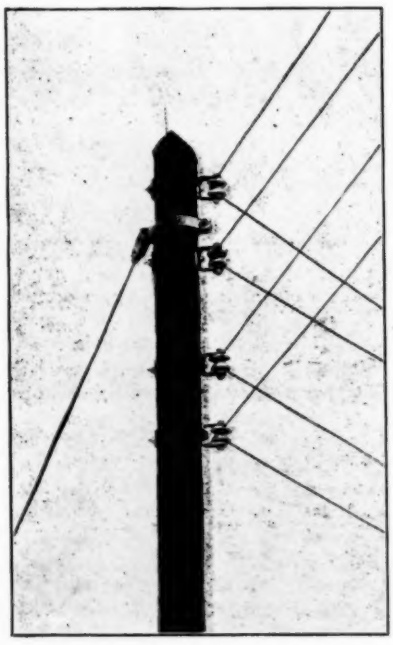

Fig. 16.—Corner Pole Arrangements.

at 23 ft. 9 in. above ground level, call this H, and if the stay be fixed at a height of 22 ft. above ground level, call this H_1, then the horizontal pull required to balance the 1,400-lb. pull, P, due to the failure of one lighting wire, will be—

$$P_1 = P\ [1 + 3(H - H_1)/2H_1]$$
$$= 1{,}400\ [1 + 3(23.75 - 22)/2 \times 22]$$

$= 1{,}566$ lb., or approx. 12 per cent. in excess of the original figure of 1,400 lb., fig. 17.

If the stays are fixed at an angle of 30 deg. to the pole, the resultant stress in the stay will be, as previously shown— $S = P/\sin\phi = 1{,}566/0.500 = 3{,}132$ lb.

For this pull a 7/8 S.W.G. stay wire, $\frac{5}{8}$-in. stay rod,

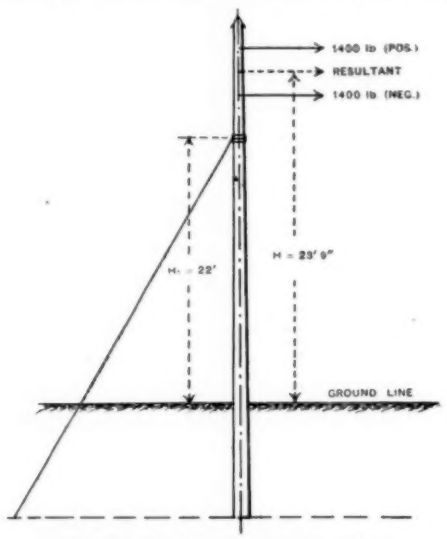

Fig. 17.—Stay Wire below Resultant Pull.

and 4 ft. × 8 in. × 4 in. stay block buried, say, 5 in. deep, will be satisfactory.

13.—Road Crossing.

The line crossed a minor village road, and although the "Regulations for Overhead Lines" above quoted do not call for any special precautions to be taken when the pressure does not exceed 250 volts direct or 125 volts alternating, the local authorities expressed a wish that insulated wire should be used.

One pole was planted at each side of the road, and a steel messenger wire fixed between them, carried by means of eye bolts, fig. 18. The V.I.R. taped and lead-

Fig. 18.—Road-crossing Pole.

covered cable is carried from this wire by means of 7 in. × 1 in. raw hide suspenders spaced at 2 ft. centres.

The distance between the poles is approximately 30 ft., and the dip was therefore regarded as negligible.

The stress in the messenger wire is approximately equal to the sum of the line wire stresses, *i.e.*, 3,200 lb., and assuming a factor of safety of 2, the

breaking load should not be less than 6,400 lb., so that a 7/8-S.W.G. g.i. stay wire and steel wires of smaller section (but of equal strength) may be used.

Assuming the breaking weight of wrought iron to be 50,000 lb./sq. in., data for the eye bolts is as follows:—

Diameter (inches).	Net Area.	Breaking Weight.	Safe Load (at 9,000 lb.).
¼	0·027	1,350	243
⅜	0·068	3,400	614
½	0·121	6,050	1,090
⅝	0·204	10.2 0	1,824
¾	0·304	15.200	2,734
⅞	0·422	21,000	3,800
1	0·554	27,500	4,990

One stay wire was fixed to each of the road poles.

14.—Cross Arms.

Under conditions in which it is convenient to use cross arms, wood and galvanised iron are available. Wood arms are of either oak or karri, the standard dimensions being—

Breadth	Depth.	Hole for insulator spindle.	Hole for arm bolt.
2½	2½	11/16	9/16
3	2½	11/16	9/16
3	3	13/16	11/16

For power-line work the insulators are normally spaced at either 18 or 30 in. centres, but the G.P.O. standard 48-in. arm, for four insulators, has the two inner centres at 18 in. and the two outer centres at 42 in. centres.

The G.P.O. uses 2½-in. square arms for wires up to 400 lb./mile (0.0206 sq. in. copper) and 3 × 2½ up to 800 lb./mile (0.036 sq. in.); 3 in. × 3 in. are used for terminating. G.P.O. vertical spacing of cross arms is 12 in., the top arm being 9 in. below the top of the pole. For the sake of appearance, the arms, where used, should be all fitted on one side of the pole, *i.e.*, the feed or the load side, except, of course, at terminal poles. In this case they should be fixed on the side of the pole remote from the pull, so that the strain is taken on the pole and not on the fixing bolt. The standard size of channel iron normally used is either 3 in. × 1½ in. or 3½ in. × 2 in. Poles are normally slotted to a depth of 1½ in. for fixing cross arms, the width of the slot being such that the arms have to be driven into position.

The fixing bolt should be driven through the pole with the small washer and the head of the bolt against the pole. The large washer and nut are placed against the arm.

(To be continued.)

Electricity in the Treatment of Milk.

Some Impressions of a Modern Electric Dairy.

AN excellent example of the part electricity can play in the purification of our food supplies is the treatment of milk in the dairy before distribution. Cleanliness in the dairy is, of course, of paramount importance, and the pasteurising treatment for this important commodity is fast coming to be considered essential, especially when milk has been transported over long distances to our large cities and towns. Competition in the milk industry is keen, and it is vital to the dairyman, if he is to employ efficient methods for the purification of the milk, that his working costs should be at a very low figure. It is in this direction that electricity can play such an important part, and some observations made, and information collected, during a recent visit to a modern electric dairy are very convincing. The dairy in question is that of Messrs. A. Stapleton & Sons, Ltd., at Stoke Newington, which distributes over 6,000 gallons of milk daily. Here electricity is used for cold storage, pasteurising, bottle washing, filling, and sealing, cream preparation, water and milk pumping, and milk conveying. Two thousand gallons of milk are dealt with each day, and 60,000 bottles are washed, in addition to which large quantities of cream and butter are prepared. The electrical energy bill amounts to about £500 per annum; the total kWh consumed during the year ended March, 1926, was 101,211, at an average cost of under 1.25d. per kWh, being about 0.3 per cent. of the selling price of the milk. Thanks to the skill and efficiency of the staff, the maintenance costs are very small indeed, and work out at about £25 per annum, including inspection, lubrication, and insurance premiums. Twenty-six motors are employed throughout the dairy, representing a total capacity of 132 h.p., and ranging from ½ to 12 h.p. each.

Fig. 1 shows the general lay-out of the plant for the milk and bottle treatment prior to the pasteurising process. The milk is received from the farms in an isolated room, whence it is electrically pumped into the 1,000-gallon glass-lined tank shown on the left of fig. 1. This tank is brine-jacketed and is kept at 45 deg. F. while the milk is agitated, to thoroughly mix the cream with the other components by a small motor-driven "fan," the motor being fixed to the side of the tank. The liquid is then passed through a steam-heated preheater, its temperature being raised to 110 deg. F. It is then dealt with by a centrifugal cleaning machine, which is electrically driven at 8,000 r.p.m. The next stage in the process is cream fixing; this duty is performed by the homogenizers, fig. 1 (centre-front), which distribute and fix the cream so that the same quantity is in any equal portion of the bulk of the milk. After passing into a large tank the foodstuff is then ready for the filling machine (centre-right, fig. 1). This is of the revolving-table type, each bottle being filled during one revolution of the table. The empty bottles are received from the washing machine, fig. 1 (right), on an

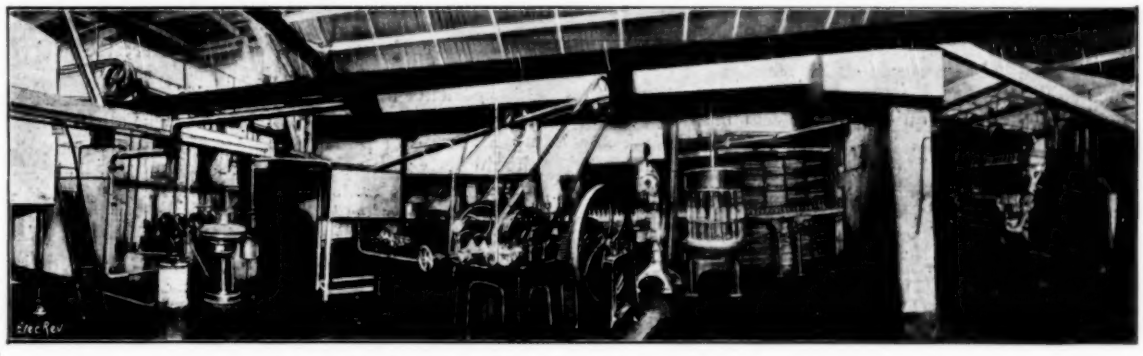

Fig. 1.—An Electrically-driven Dairy at Stoke Newington.

electrically-operated conveyor, which also carries the filled bottles, at a later stage, on to the pasteurising machine. In the washing apparatus the bottles are treated in caustic solutions, in hot water tanks and over

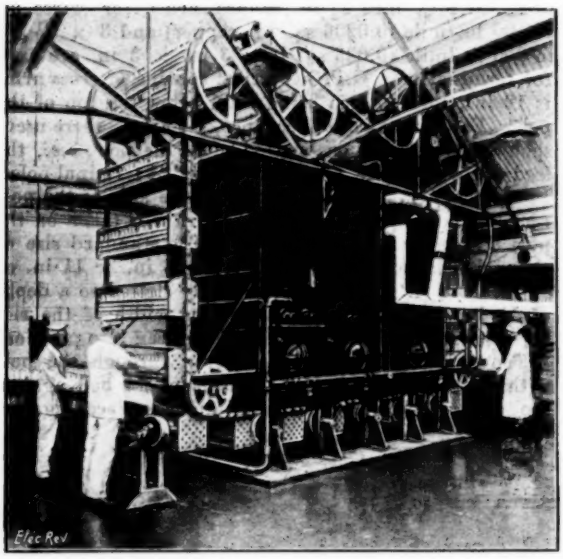

Fig. 2.—A Milk Pasteuriser.

hot water jets, the process involving 12 complete operations. The temperature of the water, 180 deg. F., is controlled by means of thermostats, and the bottles are conveyed through the various sections of the machine under electric power. The quick transit of the bottles from the washing machine to the filler, and of the milk from the preheater, enables the bottle-filling operations to be effected with both the milk and the bottles at the pasteurising temperature. The system, affording this obvious advantage, is claimed to be unique in this country.

After being filled the bottles are dealt with on a crowning machine, from which they are conveyed to the pasteuriser, fig. 2. The feature of this machine is that the motive power is supplied by a 1½-h.p. motor fixed at the top of the apparatus. The sealed bottles are passed through the heating chambers in crates arranged in the form of an endless conveyor. This completes the process as far as the treatment of the milk is concerned, and the final operation is that of sticking the "guarantee" labels on the bottles, which is done on an electrically-driven machine designed for that purpose. The driving cost for this machine is almost negligible, a very small motor providing the necessary power. The filled bottles are next conveyed to the cold-storage room, from which they are distributed as required.

Naturally, an important question in a dairy of this size is that of an adequate water supply; this is obtained from two artesian wells on the premises. These are each equipped with an electrically-driven pump, and the controlling switchgear for the motors is so arranged that the motor governing one well automatically starts up when the load on the other reaches its maximum capacity, the two machines then operating together.

The offices, &c., are equipped with electric radiators, fans, and cooling appliances, and even the Burroughs adding machine is electrically driven.

In conclusion, we are indebted to Messrs. A. Stapleton & Sons, Ltd., for their courtesy in allowing us to view the plant and providing the above-mentioned statistics. Their governing director, Mr. J. Gillard Stapleton, is an old student of Faraday House.

Electro-Farming.

The Problem of Providing the Farmer with a Supply of Electricity.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

RECENT statistics show that bankruptcy in the farming industry has increased to an alarming degree, and since agriculture is our most important industry, some steps must be taken quickly to prevent matters getting worse. The last thing to be desired is to reduce the number of agricultural workers. Rather should the present staffs be enabled to produce more without working harder or longer. The most practical way to do this is to reduce the cost of power on the farm, and this is where electricity can help; for instead of using hand power or oil engines, portable or stationary, with their time-wasting starting troubles in cold weather, power will be available instantly by the mere "twitch" of a switch whenever it is wanted.

In the course of the last seven years the author has carried out a great variety of experimental work on his 600-acre electrified farm at Greater Felcourt, East Grinstead, with a view to finding out the most suitable electrical equipment for the farm.

The result of investigation in Great Britain, on the Continent, and in the United States, has been that the power employed on the farms is greater than the demand for all other industries put together. Hence, a big load is available; the only question is whether or not it is to be supplied electrically. Few farmers who have seen what electricity can do, will deny its advantages. The trouble in this country is that so few can have it if they would. England has always been behind in the development of electricity supply, largely owing to the parochial and crippling restrictions first imposed in 1882, but of late years the subject has received so much attention that there really seems to be some hope of progress.

A matter of such wide national interest can only be properly dealt with on a national scale. The chief requirements at present are:—

(1) That vested interests should not be allowed to hold up a scheme of public service; for instance, wayleaves should be obtainable without the endless negotiation and exorbitant rents at present needed.

(2) That overhead lines should be erected with no more restrictions than are considered necessary in connection with other public utility services; for instance, the guarding called for at road and railway crossings is often a sheer waste of money.

(3) That the first cost of the lines should not be made unnecessarily high by insisting on an absolutely continuous supply in rural areas, and also on a very small range of voltage variation.

(4) That some form of long-term loans at low rates of interest be arranged for rural line construction, since until the load has developed as a result of propaganda, the lines cannot be remunerative.

(5) That, as a safeguard in the use of this outlay, the authorities receiving it should be compelled—

(*a*) to undertake an intensive educational publicity campaign in the uses of electricity;

(*b*) to commence repaying the loan as soon as revenue permits.

(6) That full powers should be given to some such authority as the Electricity Commission to compel promoters of development schemes to make them fit in with the national policy.

All these points have been sadly neglected in the past, and probably the British character has a good deal to do with this. The length of our civilisation has

caused a mass of legal difficulties to surround any attempt at progress. Again, British farmers are so independent that they have no wish to combine to carry out any scheme of electrification, as they do in France and other parts of the Continent.

Whether the farmer's load is well distributed or intermittent, large or insignificant, depends entirely on whether he is helped and taught to use the supply to the greatest advantage. It is best for him to start in a small way with lighting and one or two portable

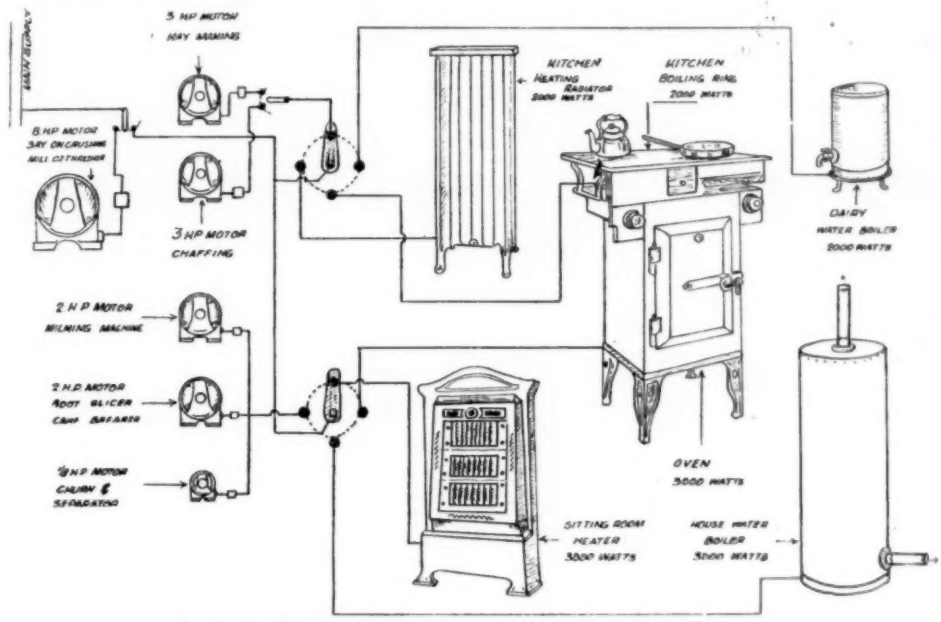
5 HP MOTOR
HAY MAKING
KITCHEN HEATING RADIATOR 2000 WATTS
KITCHEN BOILING RING 2000 WATTS
DAIRY WATER BOILER 2000 WATTS
3 HP MOTOR CHAFFING
2 H.P. MOTOR MILKING MACHINE
OVEN 3000 WATTS
SITTING ROOM HEATER 3000 WATTS
HOUSE WATER BOILER 3000 WATTS

Fig. 1.—Diagrammatic Scheme for 100 per cent. Farm Load Factor.

motors, and perhaps an electric iron and kettle in the farmhouse. After a time he will find it best to provide permanent motors for driving the most important barn machinery. Since each of these will be in use only for a short time each year, it is unfair to base the tariff on the connected load. It should rather consist of a fixed charge based on an integrated, or average, maximum demand and a low rate per unit. This encourages the farmer to use one motor at a time instead of all at once. As a means of ensuring a good load factor, the writer has devised a system of restrictive switch control whereby the load cannot exceed a definite amount. For example, when the electric oven in the house is in use, the larger motors in the farm buildings cannot be switched on (fig. 1). This only means a little rearrangement of the farm work, the trouble of which is compensated for by the saving in electricity bills. If possible, matters should be so organised that no motor exceeds 5 h.p. Even threshing can be accomplished with this amount of power.

The only purposes which will call for more power than this are threshing and ploughing. Both of these are in very successful use in France and other Continental countries, and there is no reason why, if properly arranged, they should not form a steady load for at least 200 days in the year. For electric ploughing there are two thoroughly practical types of equipment. One, on the wire-rope system with motors of 60 to 150 h.p., has an enormous capacity for work (up to 30 acres per day, as against only an acre per day for horse ploughing), and is suitable for contractors and co-operative societies. The other consists of a tractor fed by a flexible cable and having a motor of about 25 h.p. The latter method is more suitable for the average farmer, or for two or three farmers in combination to purchase, for the capital cost is so much lower.

In planning the rural distribution system, provision for these larger loads must not be overlooked, for they will be the most profitable; on this account, the intermediate distribution pressure must not be too low.

The Government scheme recently made public is an attempt to deal with the question, and all who have the cause of progress at heart will hope that ancient traditions will not be able to hinder the best solution, as has been the case with other recent attempts to introduce order into the electricity supply industry. The scheme, however, raises many controversial points. So far, it favours the towns rather than the rural areas.

Many eminent engineers consider that little or no saving would result from linking up large generating stations by spending a huge amount of capital on a network of long-distance extra-high-voltage lines, since the load on each of the stations varies during the day in a similar way. They, however, seem entirely to overlook the enormous potential rural load. Again, in many cases the cost of tapping these lines in accordance with British ideas, to supply the farming demand, would be prohibitive. An English figure for a farm line connection of £300 has been quoted. On the Continent the writer has often seen ploughing and threshing equipments connected to 30,000-volt overhead lines by means of simple hooks at the end of

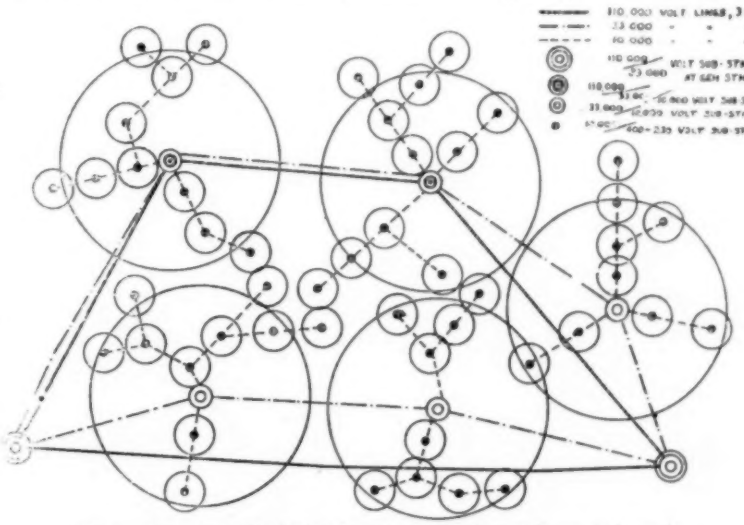

Fig. 2.—Four-voltage Distribution Layout with Tappings at Economic Intervals (small circles represent 3-mile l.p. radii).

light insulated rods. This is, of course, the other extreme, and is by no means to be advocated here. Still, there is a happy mean. Of course, it is absurd and also bad engineering to talk of tapping extra-high-pressure lines for single farms. In accordance with modern practice, 30,000-volt sub-distribution lines should be installed. They need only be tapped at their economic limits. From these, subsidiary 10,000-volt

lines should be fed. The latter in their turn, at intervals say, six miles, should provide for the requirements of each locality, within a three-mile radius. Here the pressure should be 400 volts, three phase for power, and 230 volts between any one of the phases and neutral for lighting.

A typical lay-out on these lines is indicated in fig. 2. An important factor that is generally overlooked is that to supply a rural area it is not necessary to install a complete network. The reason for this is that the villages, hamlets, and farms are usually located along the main roads. Hence it is much cheaper and easier to supply electricity to the countryside than most people think it to be. Again, a few districts only should be connected up at once, and in such areas an intensive publicity campaign should be carried out. Thus, a paying load will be obtained promptly, instead of having to await the efflux of time, while the demand is building up, and the income is insufficient to cover interest charges.

It will be seen that the problem of providing the farmer with a supply of electricity is not so difficult as some people (who have not had an opportunity of studying the matter) think.

Compensation for Loss of Employment.

(By a Legal Contributor.)

THOSE who are employed by electricity supply authorities are only too well acquainted with the fact that when there is an amalgamation, or a taking over of a small by a large undertaking, some unfortunates are or may be adversely affected. Indeed, it is this form of interference with vested interests which sometimes interrupts the progress of the "reformer" or (if that is not the right word) the amalgamator of electrical undertakings. It is interesting, and may not be unprofitable, to consider the terms of the Act of Parliament which gives certain rights to those who are deprived of employment by no fault of their own.

The Electricity (Supply) Act, 1919, contains a section of general application which is probably a reproduction of something which had appeared in a number of private Acts. Section 16 of the Act (as amended by Section 12 of the Electricity (Supply) Act, 1922) provides that if after May 8th, 1919, and within five years from the date when, under or in consequence of the Act (*a*) a transfer of the whole or any part of an undertaking has been effected; or (*b*) a scheme for the improvement of the supply of electricity in any district has come into operation; or (*c*) an agreement or arrangement between various authorised undertakers for the rendering of mutual assistance to one another has been entered into—then compensation shall in certain events be payable. Pausing here, it is not clear why the date May 8th, 1919, was chosen. The Act of 1919 was not passed until December 23rd in that year. The section then goes on to provide that if, after May 8th, 1919, "any officer or servant who has, before that date, been regularly employed in or about the undertaking or any authorised undertaking, proves to the satisfaction of a referee or a board of referees appointed by the Minister of Labour that in consequence of any such transfer, scheme, agreement or arrangement he—(i) has suffered loss of employment, or diminution of salary, wages or emoluments, otherwise than on grounds of misconduct, incapacity, or superannuation; or (ii) has relinquished his employment in consequence of being required to perform duties such as were not analogous or were an unreasonable addition to those which before the said eighth day of May he had been required to perform; or (iii) has been placed in any worse position with respect to the conditions of his service (including tenure of office, remuneration, gratuities, pension, superannuation, sick or other fund, or any benefits or allowances, whether obtaining legally or by customary practice), and the body to which the undertaking is transferred does not show to the satisfaction of the referee that equivalent employment is available, there shall be paid to him by that body or those undertakers . . . such compensation as the referee . . . may award, including any expenses which the officer or servant necessarily incurs in removing to another locality."

A proviso to the section lays it down that the compensation shall in the case of an officer employed on an annual salary, be based on but not exceed the amount which would have been payable to a person on abolition of office under the acts and rules relating to the Civil Service.

The circumstances in which compensation has been paid may be illustrated by one or two cases. Thus in August, 1923, the Llandudno Urban District Council entered into an agreement with the North Wales Power Company for a supply of electricity in bulk, the North Wales Power Co. being authorised by an Act passed in 1904. The agreement provided that the Council should advance the capital for the construction of the necessary transmission lines for giving the supply, which condition necessitated an application to the Electricity Commissioners. Although the actual supply was to be given under the powers contained in the North Wales Power Act, 1904, the Electricity (Supply) Act, 1919, Section 19, was invoked for the purpose of providing capital for the execution of the works involved in giving the supply. By reason of the agreement, the Llandudno Council ceased to generate its own electricity, and one of its employés was dismissed. He secured an award of £50 and costs.

In another case, the Electricity Commissioners having approved of a bulk supply of electricity by the Corporation of Leeds to the Morley Corporation, the Morley generating station was shut down, and claims were made by officials of the Corporation for compensation for loss of office, and on account of being placed in a worse position as regarded conditions of service. A referee appointed by the Minister of Labour made certain awards. He decided that the borough electrical engineer should have £140 on account of his being placed in a worse position as regarded conditions of service by reason of the fact that he was no longer able to take pupils. The referee found that a contention that the engineer had been placed in a worse position as regarded diminution of duties had not been proved. Shift engineers were awarded various sums for loss of employment. The referee ordered that the said sums should be paid by the Morley Corporation, but he left the parties to pay their own costs. The actual circumstances which led up to these awards are not known to the writer; but it seems odd that the referee in the Morley case should have left the successful applicants to pay their own costs.

More recently, compensation was awarded to four employés of the Ayr Corporation undertaking whose services were dispensed with when the undertaking was transferred to the Ayrshire Joint Board (*vide* ELEC. REV., July 9th, p. 82). In this case the applicants' costs were ordered to be paid by the Board.

Like many another important section of an Act of Parliament, the enactment which confers the right to compensation appears to be unduly long; but it is impossible to compress or summarise it without omitting some important qualification. It is well, however, to examine some of the leading phrases. Thus compensa-

tion is payable to "*any officer or servant who has, before the 8th May, 1919, been regularly employed in or about the undertaking.*" The first point to notice is that a person need not have been employed *on* the date in question; it is enough that he has been employed before that date. But employment before that date does not necessarily entitle him to compensation; for it may be that he was employed casually 25 years before, or that a week before he was dismissed for misconduct. He must not only prove that he was "employed," but that he "*has suffered loss of employment or diminution of salary, wages or emoluments, otherwise than on grounds of misconduct, incapacity, or superannuation.*" To leave the questions (1) was he employed before May 8th, 1919? and (2) did he suffer loss in consequence of this Act? to judicial decision, evinces great wisdom on the part of those who were responsible for the Act; because it is manifest that the amount of "loss" sustained must vary within very wide limits. Further, the question whether a particular man has suffered loss in consequence of the Act must depend on a variety of circumstances. If the post which a man actually occupies is abolished, no great difficulty can arise; but he may secure a better post elsewhere at once, or it may be shown that he was taken on upon the express terms that if there was an amalgamation, he should make no claim for any loss.

It will be seen that the persons entitled to compensation are "officers" or "servants." It is obvious that a borough electrical engineer is an officer, and that a shift engineer is a servant; but there are other persons employed in or about an electrical undertaking whose position is not quite so plain. Take, for example, the consulting engineer. If he is called into consultation every now and then and paid a fee each time, he could hardly be said to be an "officer" of the municipality or other body responsible for the undertaking. On the other hand, if he were paid an annual retaining fee, and the result of an amalgamation were that his services were dispensed with, he might well say that he had suffered loss. It is important to note that the Act does not say that an officer or servant must have held office for any particular time, or that he must have been paid annually, monthly or weekly. Everything is left to the referee who, having regard to the wide terms of the Act, is given an absolute discretion. That a consulting engineer is entitled to consideration is borne out by those words of the section which entitle a person to compensation who "has been placed in any worse position in respect to the conditions of his service (including tenure of office, remuneration, gratuities, pension, superannuation, sick or other fund, or any benefits or allowances whether obtaining legally or by customary practice)." There has only been one judicial decision upon this section—namely, that of the King's Bench in *The King v. The Minister of Labour* (1924) 2 K.B. 210. It was there held that the referee appointed by the Minister is in the position of an arbitrator, and has power to determine whether the transfer of the undertaking giving rise to the claim has been effected "under" the Act of 1919 as well as the *quantum* of compensation payable. If the claimant fails to satisfy the referee that the transfer was "under" the Act of 1919, the question whether it was in consequence of that Act is, by the Electricity (Supply) Act, 1922, to be determined by the Electricity Commissioners.

Meditations on Remuneration.

By T. J. B.

A FEW weeks ago a correspondent again raised the question of engineers' salaries. It will be agreed that there is something rotten in the state of engineering, or in the engineer, when an A.M.I.E.E. 30 years of age is rewarded with the princely sum of £3 per week. In Jerome's "The Passing of the Third Floor Back," a young lady asks what her lover has to offer, to which the Stranger replies: "Poverty, struggle, hopes, fears, pain, joy, love, life." A young engineer asking what engineering has to offer him might justly be given the same reply. We may perhaps omit love, and possibly joy, but most engineers can claim to have experienced the rest of the items on the schedule, including pain in various forms, and life, of a kind, when a feeder pillar in the middle of Puddleton Heath blows up at midnight during a nasty November gale.

The profession is overcrowded, but we are always told by our more successful business men that there is plenty of room at the top. Perhaps this is so, but a lot of climbers have had a long start, and once at the top they do not show any undue haste to retire or die. As engineering becomes more standardised, and innovations and improvements become more uncommon, so the number of responsible technical positions available bears a smaller proportion to the volume of work carried out. The coming electrical age may prove to be a great time for salesmen, but it will not necessarily prove to be the golden age for every electrical engineer. Perhaps it is not too much to say that many men have grown old waiting for electricity to outgrow its infancy.

Let us assume that there is room at the top. How does one get there? For a start one attends an engineering college for three years or more at a total cost, including fees and living expenses, of upwards of £600. The budding engineer then serves an apprenticeship in a works. If we assume that his pay will balance the premium and the cost of technical books, &c., his expenses over three years will amount to at least £450; a low enough figure, with motor-cycles at £50 each, and hospital charges averaging £5 per crash. It is at this time that most of the pain and the life is experienced.

Six years have passed, and the climber has expended over £1,000 in learning how to put his foot on the first rung of the ladder, and in living whilst learning. What has happened to a youth who has gone straight from school to a local job with "no prospects." He has been earning money all the time, has been able to live at home, has had no necessity, probably, to expend money on text books, or additional instruction. Over the six years he has been practically self-supporting, and may be earning £3 per week at the end of the time. He is £1,000 up on the engineer.

Our hypothetical engineer has finished his time. Very likely there is no vacancy for him at his works, and after some little difficulty he finds a job at perhaps as much as £150 per annum. He is assured that the experience will be valuable, and as he has had no commercial experience the salary offered is generous.

After another few years he is still gaining valuable experience, and his pay has brought him just within the clutches of the Income Tax assessor. He doubtless has to live in an unpleasant town, and in indifferent lodgings; this may not do him any harm and may add still further to his experience, but it may detract from the joy his love has to offer him. He is still interested in his job, buys expensive text books and attends courses of lectures, but does not plough into a problem with quite the zest he exhibited a few years ago. He is finding that experience is considered to be almost equally as important as technical knowledge. The shop assistant lives inexpensively at home, spends his evenings at tennis or dances, and keeps about level with the engineer's salary.

A few more years pass. If he has a first-class brain, can wield a slide rule with dexterity, and enjoys light reading of the mathematical tables type, our climber

may have advanced a few rungs into the design office where his salary may be anything up to £300 per annum, according to the supposed value of the experience he is gaining. If he is wise, however, he will change his job every few years to learn new methods, and to acquire more knowledge, and this course will retard his ascent. The shop assistant is doing a steady £150, and although he may have dropped behind in the salary race, his expenses are less, and he has a small but growing bank balance. A number of years at £50 per year are needed to wipe off that £1,000 start. The shop assistant, in company with a local tradesman's daughter, is comparing the merits of different "plain van" firms. Father is expected to lend financial assistance when a likely shop comes into the market.

At about this time, perhaps, the engineer takes unto himself a wife, and experiences poverty, struggle, and, let us hope, love. If he is an average sort of fellow he has given up trying to keep one step ahead of engineering progress; the innovations of to-day will be all contained in convenient form in the hand-books of to-morrow. He spends his spare time in the garden or in writing letters consigned to an address we all know well. He needs a little extra money badly, but so do some dozens of other men of equal qualifications, and the odds are heavily against him. He has formed the habit of applying for a rise twice yearly, and probably vows that when he dies "Box — c/o The Electrical Review" will be found engraved on his heart. Perhaps he tries to make a little extra money by overhauling old cars and selling them at a profit, which pays him a few pence per hour for his time, or he tries short story writing and finds that even in this sphere experience is essential to success.

Perhaps, middle-aged and tired, the climber rests on a middle rung and receives about £30 when each month draws to a welcome close. In a few exceptional cases, when a little extra ability has been helped by a little luck in taking a fortunate tide at the flood, he may be a department manager, a successful salesman, or a chief assistant waiting for the chief to retire, and meanwhile writing after every suitable vacancy advertised; such jobs bring in £500 per annum, or slightly more. His really brainy friend, who can integrate between any given limits and can make 0.999 lb. of steam do the work formerly done by 1.0 lb., reaps an almost equivalent reward.

What of the shop assistant? He started years back with a little shop and a smaller stock, and now has a large and flourishing business. He has plenty of common sense, a good cutter, but no other qualifications, yet misguided men cheerfully pay him vast sums of money for a few yards of cloth fashioned in the form of a suit. His father-in-law, the family grocer, is doing nicely, thank you, and may be expected to leave a comfortable pile when he shuffles off this mortal coil. The chief engineer of the local electricity works associates with the doctor, the solicitor, and other professional men who set one another a high standard of living, but Mr. Snips, the tailor, can take his pleasures with Mr. Tom, Mr. Dick, or even Mr. Harry.

A few brilliant men, combining commercial aptitude with technical skill, may reap a richer reward, but the rank and file must be content with the satisfaction of doing a useful job well. Perhaps every shop assistant does not become a shop proprietor, but then, not every engineer rises to even £500 per annum.

I know what my love has to offer me—a strong incentive to save enough money to start activities in some other sphere. I would like to run a pirate 'bus over a tramway route, but the Ministry of Transport might object. Failing that, I may open a restaurant at which engineers will be allowed trade terms, but no credit. Yet, when I suggest making a complete break my wise friends point to the expensive training which would be wasted. Probably in years to come I shall still be shunting a cursor up and down the slide rule, and drawing as much pleasure from that occupation as I should from selling a five-shilling shirt for half-a-guinea.

Who has ever met a man who is really satisfied with his job?

The Direct-Current Apparition.

Some Considerations on Changing-over.

By "INVICTUS."

THE change over from d.c. to a.c. 3-phase distribution is a problem which is intriguing many supply engineers at the present moment. The desirability of the change is obvious in view of present progress, the official standards and the losses of conversion, to say nothing of the cost of rotary converting plant and its upkeep in the form of shift wages.

Upon the score of losses alone we may see 15 per cent. mentioned between an a.c. source of supply and the d.c. switchboard.

In an undertaking selling 2 million units per annum, at an average cost of 0.8d. per unit, the loss represented is £1,000 per annum, or a sum of £10,000 when capitalised at 10 per cent. Five years hence such losses might represent double this amount.

Complete rotary equipment costs about £5 per kW, say, £7,500 for a 1,500-kW station, and additions would have to follow. Wages paid for shifts would run to another £1,000 a year, or £10,000 if capitalised.

Here, then, are represented capital potentialities of not less than £27,500—almost as much as the existing distribution scheme of the imaginary undertaking has cost up to date, and most of it is probably paid for by amortization.

But the losses of conversion may not yet have been felt, because a.c. is not yet in use. Meanwhile, the station has to run, probably *will* have to run in any case, so that shift wages, most of them at any rate, will have to be paid for some time to come, even if a bulk supply is taken. The only remaining consideration then, for the present, is the possible expenditure if the rotary equipment were to be installed. This may be viewed as a potential item of capital expenditure incidental to any a.c. supply, so the sum indicated, or a portion of it, may be considered in relation to the conversion of a part of the distribution system to a.c.

With the advent of standard current there will be certain improvements in running and distribution efficiencies, possibly also in actual costs for energy. Averaged and capitalised, these may suggest quite useful additions which the undertaking could afford to carry. All that can be carried may well be applied to changing over the distribution system.

Perhaps a bulk supply can be hastened; if not, it is likely that there will have to be a plant extension. It should surely be an alternator and a reversible motor-generator. If additional plant is not essential, or if a bulk supply is in prospect later on, the motor-generator and perhaps a few transformers purchased now would enable a start to be made with the change-over. Such equipment is likely to prove serviceable as separate units later on, where a rotary converter and its transformer would not.

It will be a fascinating amusement to take a new map of the area and lay out an entirely new scheme in general principle, co-ordinating here with existing arrangements and remodelling there to produce that result which, of course, ought to have been foreseen by those people who made such a mess of it at the beginning! So the whole scheme may be drafted and divided,

in a general way, into, say, ten sections, to be dealt with progressively.

A little "stunting" with single-phase transformers provided with some well considered tappings for pressure adjustments, perhaps a l.p. auto-transformer or two, or even a small mobile motor-generator, will enable gratifying arrangements to be made when the actual change over of each cable length is effected. The engineer will sometimes have to do things he would rather not, such as temporarily running single armoured cables with a.c., ignoring the strict letter of the present law in the matter of pressure limits and other extremely practical expedients, but the end will justify the means.

When running h.p. feeders through streets not scheduled for new distributors, a cheap class of conduit can be laid in the trench opened, with the idea of drawing in an armoured distributor at a later date, when the conduit can be broken out for service joints, with no intention of using surface boxes.

When computing copper sections it is well to think handsomely. The h.p. feeder arrangements, if of the order of 3,300 volts, will provide for future developments by additional transformer kiosks or sub-stations, as the load increases. If the distributors cater for twice the present load when fed at the initial transforming points, those anticipated for the future will enable the distributor capacity to be almost indefinitely increased, with judicious sectionising in street pillars. Distributors once relaid may be considered down for good.

Efforts should be made to induce consumers to go over to some form of assessment tariff or group-graded flat rates, so that only one meter per consumer will be required when the change of system is carried out. Careful pre-consideration of the tariffs may enable large savings to be made in meters. For instance, it is not unusual to find several odd rates in force, such as, lighting 7d., heating 2d., power 3d. to 1½d.; rateable value, plus 1½d; and a fixed charge for installed watts in shops, plus 4d.; so that a tradesman living over his place of business and using a motor in his workshop might require four or five meters to deal with his account. No doubt this exaggerates actual practice, but it emphasises the need for all possible unification of unit rates. Meter rents may be a sound return, but they are something of an imposition from the consumers' point of view, whilst the prospect of wholesale replacement will possibly amend the other aspect.

Tariffs can be made to anticipate this as well as most other future probabilities, such as the "quarter-watt" lamp, which is a splendid prospect but should also be a warning to all those who contemplate further unnecessary cuts in the price of purely lighting units. All those future margins which improving efficiencies of consuming apparatus bring to a carefully planned tariff will be needed to provide for increasing loads, whilst remaining competitive with the next best medium. A mistake frequently made when setting out ordinary flat rates is to quote for power loads as low as for domestic heating and cooking. Power loads between them will have an appreciably lower load factor than the future domestic loads, on account of the great diversity of large numbers of household loads. Moreover, domestic loads will continue to include lighting, for which lighting values will be paid; this, together with the lower rates for other domestic purposes, will only be required to find an economically correct and commercially just revenue against the common basis for all right tariffs, namely, standing charges and running costs.

The principal terror of the change-over proposition is, possibly, the contemplation of replacing consumers' apparatus free of charge. A live sales department will enormously reduce these fears. Much of the recovered d.c. apparatus can be hired out at most attractive rates to remaining d.c. consumers. Where a.c. apparatus has to be supplied, increased horse-power or improved devices can be traded and the cost eased accordingly. The sales department will also be called upon to job off all surplus recovered stores to the best advantage, by watching and looking for new markets and opportunities.

New consumers must be sought strenuously and persistently, with all possible wiring assistance. On the d.c. system they will absorb some, if not all, of the recovered meters and apparatus; even recovered cable may come in for services, whilst if new streets have to be served, it may be found practicable to use up old cable by drawing it into conduit, for comparatively easy replacement later on.

Supply engineers will have considered all the points referred to in the foregoing paragraphs, as well as others not mentioned; but a little grouping of obvious considerations does diminish the proportions of the conversion bogey. An alternative method of writing upon the subject would be to enumerate some of the obvious things to be avoided. It would make more tiresome reading than the positive method here attempted. There are two general features which may, however, be worthy of mention as specially important forward thoughts: have no low-pressure feeders in the completed a.c. system, and "jolly up" the power factor by every economical expedient.

Thanks to the progress our industry is making, nothing is at present large when it is set off against probabilities a few years hence. The tackling of the problem of conversion will add more zest to life than evading it. The all-powerful medium is a panacea which should be applied like embrocation to chairmen, councillors, directors and others, including the reader who has read as far as this—it is a brisk, well-founded and apparently costly sales staff.

One doubts Goliath's real might with the knowledge of David's slick prowess!

Another Domestic Refrigerator.

The Delco-Light Co.'s Electrically-driven "Frigidaire" Apparatus.

In modern house planning much thought is given to the arrangement of the kitchen and its equipment so as to facilitate the preparation of food, but how often is its storage and preservation taken into account? The protection of food against contamination and spoilage needs serious consideration, for its freshness and purity have a direct relation to health, and the recent warm weather forcibly directed attention to the fact that inadequate refrigeration is a subject of concern.

"Frigidaire" apparatus is a complete mechanical cold-storage plant designed for use in the home and other establishments which require a moderate amount of refrigeration. The cooling coils are located in the ice compartment and connected to an electrically-driven compressor which refrigerates by evaporating and condensing a liquid; the "frost coil" may be of various shapes and may enclose a nest of freezing trays in which block ice can be produced, or they can be utilised for making dessert ices, &c.

The refrigerant used is sulphur-dioxide, which lends itself admirably to the smaller type of machine; it is non-poisonous, non-inflammable, and non-explosive; its boiling point is 14 deg. F. at atmospheric pressure, and there is a large factor of safety, as the normal operating condensing pressure is comparatively low (60 to 70 lb.). Replenishment of the refrigerant is unnecessary.

The device operates on the principle that flooding takes place in a cooling coil which is entirely filled with the liquid refrigerant and controlled by a float valve, permitting more liquid to enter the coil to replace

that which evaporates. All parts of the coil are made of copper, brass, or monel metal, all incorrodible materials of high conductance. No brine tank is employed, the heat passing direct to the coil itself. The copper condensing coils are mounted on both sides of the compressor and lead to a receiving chamber, in turn connected with the liquid line leading to the cooling coil. In the flywheel of the compressor is incorporated a fan which blows air over the condensing coils, assisting the dispersion of heat as it is drawn from the cooling coil.

The compressor is driven by a fractional-h.p. motor and its pistons are a lap fit, operating without rings. The drive consists of a large eccentric, the purpose of which arrangement is to obtain a wearing surface on the moving parts about five times what it would be if an ordinary crank shaft and piston rings were employed. The back-pressure valve is located at the top of the compressor, and consists of a simple spring-type of flapper, quiet in operation, and the motor drives the compressor by a "V" belt, without idlers, in grooved pulleys.

The automatic control of "Frigidaire" apparatus is claimed to be unique in that it has eliminated the thermostat. For a given temperature in the cooling coil there is also a definite pressure, and any change of pressure reacts on the control mechanism; from the suction side of the machine a small tube leads to bellows, which collapse and expand as the pressure changes, actuating in turn the switch which starts and stops the motor at intervals of approximately 1½ hours, thus maintaining an even temperature and dry atmosphere in the refrigerator in which it is installed.

The outfit is simple to install, requiring no water connection or plumbing, merely attachment to suitable electricity supply mains. It is made in various models and sizes for domestic and commercial use, including all-metal cabinets insulated with solid corkboard. A product of the Delco-Light Co. and General Motors Corporation (U.S.A.), "Frigidaire" plant is said to be serving 150,000 users in America.

It is a mistake to suppose, as many do, that this country is too conservative to adopt a food refrigerator system for the average household. Hard facts prove the contrary: "Frigidaire" cabinets and plant have been on sale in the United Kingdom for less than four years. In the first year about 100 were sold; in the second 400; in the third 5,000; and figures for this year indicate an estimated sale of 10,000. One firm here has installed £150,000 worth of such plant. The Delco-Light Co. last week opened a fine showroom at Imperial House, Kingsway, London, where various complete refrigerators can be seen and their equipment inspected.

Wireless Transmission.—I.

A Critical and Constructive Examination of the Subject.

By CHARLES E. SNELL.

THE fact that Maxwell had postulated the electromagnetic nature of light, and that Hertz had demonstrated experimentally the existence of waves that were electromagnetic in their origin, naturally exercised a considerable influence on the notions and nomenclature applied at its inception to wireless telegraphy.

With the knowledge available at that time it seemed impossible to explain in terms other than those used by Hertz the reason for the success of the new method of signalling. Hertz had observed the reflection, refraction, polarisation, and interference of electromagnetic waves, and these phenomena, being attributes of light, gave emphasis to the conclusion that wireless telegraphy succeeded by virtue of the propagation of electromagnetic waves through the ether in a manner analogous to that postulated for light waves; the sole difference being that of wave-length, which, in the case of wireless telegraphy, is many times longer than any wave-length in the visible region of the spectrum.

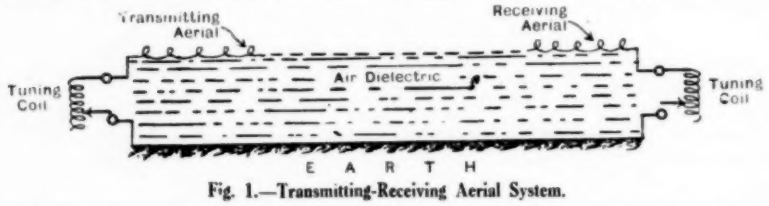

Fig. 1.—Transmitting-Receiving Aerial System.

Credence attached to this explanation the more readily by reason of the fact that the earliest type of aerial system employed in wireless telegraphy was of the Hertzian form, and in these circumstances the statemen then made that long-distance communication would be impossible, on account of the curvature of the earth, can be appreciated.

Subsequent modifications of the aerial system together with other improvements resulted, however, in the successful transmission of signals over distances which brought definitely under test the influence of the curvature of the earth, and wireless practice registered its first triumph over theory. It was well known, and in no way overlooked, that both the aerial system and the apparatus arrangement had been considerably altered in achieving this success, but it does not appear to have been recognised that the test was in the nature of a crucial experiment on the result of which depended the validity, or otherwise, of the light-wave theory in its application to wireless transmission. Later developments brought into evidence additional phenomena—the daylight effect, for instance—hitherto unknown, and the field of inquiry soon proved itself to be very complex and unmanageable from the point of view of a theory of propagation. Nevertheless, the same nomenclature and notions, derived from the science of light, persist in the literature relating to wireless transmission, and it would seem that because of their doing so progress must be considerably impeded.

It has been stated recently that the whole theory and practice of long-distance transmission is undergoing a most important and radical change, and this statement lends support to the conclusion that developments in wireless transmission have been made without the assistance of an adequate theory. The fact is that, in the absence of a recognised theoretical foundation, applied wireless science has advanced along empirical lines; and, although that is a costly method, yet it has in this case amply justified itself. The economic and scientific advantages which must follow from a proper adjustment between theory and practice are, however, quite obvious, and the first step in this direction will be taken when adequate recognition is given to the fact that the terms reflection, refraction, polarisation, and interference are not specifically limited to light waves. Analogous phenomena are identified in such widely separated instances as sound waves and land-line telephone transmission, whilst, as regards electrical science in general, one is prepared to perceive at least some of these effects in all cases where a cyclic variation of electromotive force is involved, for the reason that they are inherent

attributes of transmitted vibrations which reveal themselves under conditions appropriate to the particular circumstances.

These terms are, evidently, to be understood as representing certain phenomena which arise wherever vibrations are concerned. The conditions for originating, perceiving, and eliminating these effects differ with circumstances, and confusion of thought can, therefore, be avoided only by a careful consideration of the physical conditions applicable to the case.

In this same connection there are two terms which merit consideration with regard to their application to wireless transmission. The first of them is "wave-

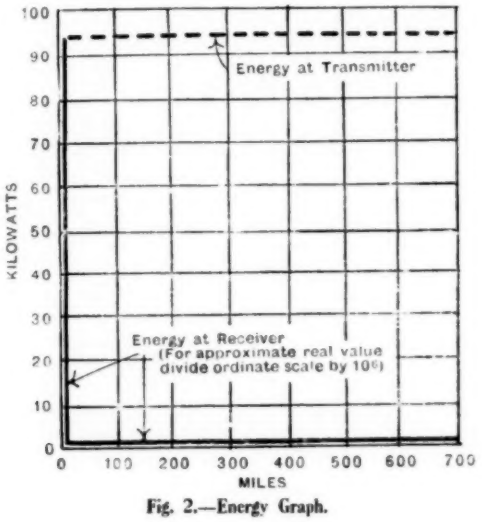

Fig. 2.—Energy Graph.

length," which, when used in conjunction with wireless transmission, appears invariably to lead to the idea of the propagation through space of waves analogous to light waves. It cannot, therefore, be kept too prominently before the mind that wave-length refers to a subsidiary attribute of transmitted vibrations arising from the natural interaction of the frequency of vibration and the velocity of propagation; the principal significance of the term being a mathematical one, since it represents the distance apart of successive identical phase relationships. The second term referred to is "oscillation," which, although it signifies simply a particular condition of vibration, *i.e.*, vibration at the natural frequency, yet seems to surround itself with something of a mystical nature in its application to wireless transmission. A pendulum vibrates in that its velocity, for one thing, varies cyclically with time; and it also oscillates inasmuch as it vibrates in its natural period.

A little consideration will readily show that with regard to motion of a vibratory character, whether it be electrical or mechanical, there are certain attributes common to diverse cases, and they can, therefore, be generalised in mathematical terms. It is when applying generalisations of this nature to physical realities that difficulties may be encountered, and in this connection the remarks of two eminent scientists are apt and worthy of careful perusal:

Dr. Heinrich Hertz says:—

"Many a man has thrown himself with zeal into the study of Maxwell's work, and even when he has not stumbled upon unwonted mathematical difficulties has nevertheless been compelled to abandon the hope of forming for himself an altogether consistent conception of Maxwell's ideas. I have fared no better myself. Notwithstanding the greatest admiration for Maxwell's mathematical conceptions I have not always felt quite certain of having grasped the physical significance of his statements."

Oliver Heaviside puts the position in the form of a question to which he provides an answer, *viz*:—

"But what is Maxwell's theory? There is the book, text, and equations which together make the theory, but for a period of twelve years following the publication of that work much difference of opinion has arisen as to what Maxwell's theory really is."

In these circumstances it is reasonable to insist that in formulating explanations of the phenomena associated with wireless transmission due regard shall be given to the physical significance of the terms employed and proper recognition accorded to the fact that, although demonstrably similar mathematically, yet there is no implied absolute identity in the physical properties of vibrations at the frequencies pertaining to the visible portion of the spectrum and those at the much lower frequencies utilised in wireless transmission.

Summarising the salient features, it can be said that:—

(1) The light wave analogy has not proved of utility in the formation of a satisfactory explanation of wireless transmission.

(2) Wireless transmission has advanced along empirical lines.

(3) The terms reflection, polarisation, &c., are not specifically limited to light vibrations; they are met with in many other cases.

(4) The particular physical significance which attaches to any terms used with reference to wireless transmission must be considered; and

(5) Mathematical generalisations involve more than one possible physical interpretation, and the difficulty in their application is in consequence of this sometimes very considerable.

The aerial system associated with a wireless transmitter is commonly thought of as furnishing the link with the ether through which the electromagnetic waves are propagated; and the manner in which the energy leaves the aerial is thought of as being in the form of "loops." There are those who consider these loops to be completely detached from the aerial; others suggest that they glide over the surface of the earth; and, finally, there is the suggestion that these loops are caused to "lean forward" under certain circumstances. Provided that they are regarded, as they properly must be, as the vectorial representation of probable phase relationships, their use accords in principle with the legitimate applications of this mathematical device, but there is every reason to think that because of the nomenclature associated with these loops many are led to impart to them a degree of material reality which is neither intended nor justifiable in the case of wireless transmission.

A much clearer understanding of the subject appears to be available by the study of a diagrammatic representation, similar to that shown in fig. 1, of a trans-

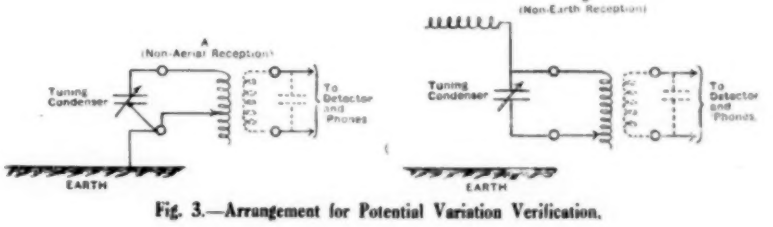

Fig. 3.—Arrangement for Potential Variation Verification.

mitting and receiving aerial system from which it will be apparent that the case resolves itself into that of two condensers of which one side, *viz.*, the earth's surface, is common to both, and the other side, *viz.*, the aerial proper, is distinguished by the fact that it possesses self-inductance. Now, in wireless reception the energy received seldom exceeds a few microwatts and the value frequently falls as low as 0.5 microwatt, which is about the limit of sensitivity of a receiver not employing amplification. This applies even when the energy at the transmitter is very considerable and the distance between transmitter and receiver quite small. The disparity between the input and received energy is so great that it is not possible to illustrate this feature with exactitude in a single graph on account of the

scale difficulty; and if, on the other hand, two graphs are utilised there will be a loss of effectiveness for the purpose in view. The graph shown in fig. 2 is, therefore, intended to exhibit only the salient feature, *viz.*, the enormous reduction in the energy observed in comparison with that employed at the transmitter, and despite the fact that scale limitations cause the graph to indicate a position much more favourable than the true case it will, no doubt, be instructive.

It is evident, therefore, that the energy observed at a distance is a minute fraction of that at the transmitting aerial which is as it should be if the explanation of wireless transmission is to be made in terms of general theory. In the arrangement depicted in fig. 1 it is apparent that the energy of the aerial is discharged to the common coating (the earth), and it follows from first principles that an enormous amount of energy would be necessary to raise the potential of this coating to any considerable extent. The position with regard to the air dielectric is similar, since a considerable volume of air is involved.

Hence it is reasonable to infer that it is only because of the extreme sensitivity of the receiving apparatus that it is possible to observe the minute variations in potential set up at the surface of the earth, and in the air dielectric, by the operation of the transmitter. It is of particular interest to observe at this stage that the two sources of potential variation can be experimentally verified by means of the arrangement diagrammatically shown in fig. 3 (*a* and *b*).

So far, then, the practical aspect of wireless transmission does not demand, in the way of theory, anything more than an adaptation of principles thoroughly familiar to, and well understood by, electricians; but for completeness it is essential that reference shall be made to the term "electromagnetic" which has unquestionably taken to itself a special significance on account of its association with the theory of light.

The term is a compound word used for the purpose of conveniently combining in a single word the two observed sources of induction, *viz.*, the electrostatic (capacitative), and the magnetic (self and mutual inductance). No electrician needs to be reminded of the fact that the electrostatic field has characteristics which render it very clearly distinguishable from a magnetic field, and it is equally obvious that although these two fields may co-exist, as they actually do exist in wireless transmission, they must nevertheless receive separate consideration. The matter is best illustrated by the instance of inductive interference met with in overhead telephone circuits. For some time it was considered that the magnetic component alone was responsible for this interference, and not until it was realised that the electrostatic field was the more important factor did it become possible to apply appropriate measures for the elimination of this interference.

By reverting to fig. 1 and considering the arrangement there shown in conjunction with these remarks it will be readily conceded that the conditions favour the predominance of the electrostatic field in wireless transmission, and practical results amply support this view. The danger of confusion entailed by the use of the single word "electromagnetic" is therefore seen, and the necessity which is thus shown to exist for a distinction between electrostatic "waves" and magnetic "waves" serves to emphasise what has been said with regard to the light-wave analogy. If the fact that the electromagnetic field embodies two components having very different characteristics, *either of which may be annulled without eliminating the other*, is fully appreciated, then it will be realised that the explanation of wireless transmission comes within the scope of well-defined theoretical and experimental considerations associated with the science of electricity and magnetism prior to the introduction of this method of signalling without wires.

Although throughout this discussion the case of an earthed-aerial system has been taken as the basis in deducing facts, it will be perceived that it is possible to extend the reasoning to explain satisfactorily on similar lines the operation of other forms, for instance, non-earthed frame aerials, and aeroplane aerials; the former being a case where the magnetic component prevails, whilst the latter shows a preponderance of the electrostatic component if a trailing aerial is used.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Second Advertisement Competition.—As was briefly announced several weeks ago, the success of our First Advertising Competition has led us to organise a second to be run on very similar lines, but with certain modifications, suggested as the result of experience obtained last time. In brief, the sum of £225 will be distributed as prizes for the best advertisements appearing in the ELECTRICAL REVIEW between July 1st and December 31st, 1926. It will be remembered that in reporting upon the last competition, the judges referred to the difficulty experienced in comparing advertisements of totally different classes of manufactures—turbines and wires, for example, lend themselves to totally different treatment in such a connection. This time therefore we are meeting this point by adopting three classifications, particulars of which are fully set forth in our advertisement pages this week. There will be three prizes of £50 each for the best six full-page advertisements in each of the classes, and three prizes of £25 each for the best six half-page advertisements in each class. Competitors may not enter more than six advertisements in each class, but they may enter for all three classes if they so desire. There must be a minimum of five entrants in each class. As before, the judges will be gentlemen of reputation and independence in the electrical world; their names will be announced later. We direct the attention of all who have to do with electrical and allied advertising to the full terms of the competition which are set out in our Advertisement Supplement (p. 54) of this issue of the ELECTRICAL REVIEW. Intending competitors can obtain Entry and Authority Forms on application to The Competition Manager, THE ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C.4.

British Trade with Portugal.—Some notes on this subject appear in a report by Mr. S. G. Irving, British Consul and Commercial Secretary at Lisbon, recently published by the Stationery Office (1s. 6d. net) for the Department of Overseas Trade. Mr. Irving says that the outlook for British trade in Portugal has improved owing, in the first place, to the recovery of the escudo, and, secondly, to the fact that a reaction in favour of British goods has begun to set in. Buyers have discovered that cheap goods are not the best in the long run. There is scope for greater efficiency in the selling methods of British manufacturers, but credit is due to those of them who are adapting themselves to the needs of the market. This adaptability has been in evidence recently; in several instances British manufacturers have combined, each agreeing to take such part of a large contract as he can best carry out, in order to submit the minimum joint quotation while offering the maximum quality. British exporters have also shown increased enterprise in giving credit. There is still, however, insufficient concentration on selling. It is necessary to make a preliminary systematic study of the market, to pay personal visits and to put the agency for a business in the proper hands. Much more advertising, particularly of a pictorial nature, might be done. It is a common practice of German firms to send advertisements and catalogues direct through the post, or to distribute them by means of local agents to possible customers. In another part of the report it is stated that the United States, France, and Great Britain supply most of the electrical goods and radio sets. Imports of British electrical goods and apparatus in 1924 amounted to £51,129. Germany and Holland divide the market for electric lamps, the imports of which were valued at £29,335 in 1924.

Electrical Equipment for Russia.—A special Commission has arrived in this country from Russia for the purpose of negotiating with British manufacturers for the supply of part of the electrical equipment for new power stations which are to be built. The chairman of the Commission, Prof. Polivanov, states that orders are being placed in foreign countries for the complete equipment of four new power stations and the extension of six others at a total cost of about £2,500,000. The principal point of the negotiations is the question of credit. Generous terms are being offered by German manufacturers, but Prof. Polivanov says that he believes that acceptable terms

will be quoted in this country, in spite of the fact that the Export Credits scheme does not extend to Russia.

The *Manchester Guardian* states that nineteen turbo-alternators of a total capacity of 300,000 kW are required, together with the necessary steam-raising equipment, switchgear, &c., as well as 115,000-V sub-stations. A great amount of plant has already been supplied by British manufacturers, including equipment for the Schatursk, Nijni Novgorod, Shterov, Volkhov, Leningrad, and Baku stations, all of which have been mentioned from time to time in our "Russian Electrical Notes." Prof. Polivanov stated that, given favourable conditions, the programmes for the next two years would each be the same as for this year, viz., the provision of 300,000 kW of plant. He also expressed the opinion that British plant was certainly not inferior to that produced in the United States and Germany; in many directions British manufacturers were unrivalled.

Trade Announcements.—In future the W. & M. WIRELESS CO., LTD., alone will manufacture and sell the "W. & M." radio components hitherto supplied by the Wainwright Manufacturing Co., Ltd.

ELECTRIC HEATING & HARDWARE, LTD., has appointed Messrs. Harwell, Ltd., 28, John Street, Theobald's Road, W.C.1, as its agents for "Komet" and "Glowincoal" electric heating appliances, for the London area; in future this will be also the London address of the company.

The address of the LORIVAL MANUFACTURING CO. (1921), LTD., is now 117, Victoria Street, S.W.1. Telephone: "Victoria 2648"; telegrams: "Lorinsulor Sowest London."

Catalogues and Lists.—THE IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—A series of cardboard cut-outs and pamphlets advertising the company's super-heterodyne equipment, condensers, coils, and other radio apparatus.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—Monthly stock list of motors and dynamos.

THE FOOLPRUFE PATENT ACCUMULATOR CO., LTD., Kettering Road, Market Harborough.—A pamphlet advertising the company's accumulators for radio and other uses, together with a form of guarantee.

THE LANCASHIRE DYNAMO & MOTOR CO., LTD., Trafford Park, Manchester.—Descriptive List 1,800, containing an illustrated description of the company's electric drive for planers and other reciprocating machine tools.

CLIMAX RADIO ELECTRIC, LTD., Quill Works, Putney, S.W.15.—An illustrated pamphlet describing equipment for providing radio h.t. supply from the mains, l.f. transformer, choke, &c.

MESSRS. HOLLINGS & GUEST, LTD., Thimble Mill Lane, Birmingham.—List No. A107, giving reduced prices of all-metal waste paper bundling presses.

CONSTRUCTORS, LTD., Imperial House, Charlotte Street, Birmingham.—A series of leaflets dealing with sheet-steel cupboards, slotted-steel meter racks, &c.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—Pamphlets advertising "Elasta" vacuum and gasfilled lamps and the company's lamp service.

THE NORMAND ELECTRICAL CO., LTD., Macaulay Road, Clapham Common, S.W.4.—Illustrated leaflets dealing with the company's fractional h.p. motors and combinations, such as battery-charging sets, grinders, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet S.4166, illustrating and describing "Magnet" bakelite b.c. adaptors. Priced.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—Publication 1397, giving particulars and prices of "B.T.H." electric fans.

VENNER TIME SWITCHES, LTD., 45, Horseferry Road, S.W.1.—A calendar-blotter advertising the company's time switches.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD., Wellington House, Buckingham Gate, S.W.1.—An illustrated booklet describing the "Macadie" automatic coil winder, the "Avometer" and "Slektun" radio coils.

THE ENTERPRISE MANUFACTURING CO., LTD., Grape Street, Shaftesbury Avenue, W.C.2.—An illustrated and priced catalogue of brass electric bell pushes.

BRITISH INSULATED CABLES, LTD., Prescot, Lancashire.—A pamphlet advertising "Prescot" enamelled wire for delicate instrument work.

Catalogues Wanted.—The BOMBAY ELECTRIC SUPPLY AND TRAMWAYS CO., LTD., is establishing a showroom in Bombay for the demonstration and exhibition of approved domestic appliances, and manufacturers' trade literature is desired, addressed: "Post Box 192, Bombay, India."

Bankruptcy Proceedings.—E. A. PYE, electrical engineer, &c., 4, Oxford Mews, Edgware Road, W.—This debtor attended last week before Mr. Registrar Mellor at the London Bankruptcy Court, for public examination upon accounts showing liabilities £1,844, against assets valued at £654. Replying to the Official Receiver, debtor said that he began business as an electrical engineer and dealer in electric lamps and signs in 1920, under the style of "Pryce and Co." That business was transferred in October, 1922, to a company registered as "Pryce, Ltd.," with a nominal capital of £2,000; as vendor he received £334 in shares; the company carried on business until April 5th, 1923, when a receiver was appointed at the instance of the debenture holder, followed by a compulsory winding up order in May, 1923. No dividend was paid on the company's liabilities, which amounted to £3,042. In September, 1923, witness again started to trade on his own account under the style of "Electro-Factors," from 8, Hyde Park Square Mews; six months later he was joined by a partner, who paid £250 for a half share of the business. The partnership was dissolved in September, 1925, the business being left with witness, he agreeing to pay his partner £275, of which £225 was still outstanding. He subsequently continued the business in verbal partnership with another person, under the same style, at 4, Oxford Mews, but differences arose between them and the business was closed down about the middle of last January. The debtor attributed his failure and insolvency to losses on trading since September, 1925, and to the action of his last partner. The examination was concluded.

H. D. DOUGLAS, wireless factor and merchant, trading as "H. D. Douglas & Co.," 32, Queen Victoria Street, E.C.4. The first meeting of creditors herein was held last week at the London Bankruptcy Court, a receiving order having been made on June 26th. According to the debtor's statements in his preliminary examination, he commenced business as an engineer's merchant in June, 1918, with £400 capital, using the name of H. D. Douglas & Co. From its commencement until 1924, the business was successful, his turnover for that year being £25,000. After 1924 his business declined, to a great extent owing to the prevailing bad trade, strikes, &c., and it had not since recovered. In March, 1925, owing to pressure by creditors, he closed down. In addition to the bad state of business he had also contracted bad debts of about £500, and sustained losses in connection with lawsuits, as a result of which he had been left without working capital. He estimated his present liabilities at £1,500, and had scheduled assets valued at £337. His failure was due to bad trade, bad debts, and law costs. Mr. E. H. Hawkins was appointed trustee to wind up the estate in bankruptcy.

J. H. WICKETT (lately trading as Paterson & Co.), electrical and general engineer, 17, Albion Street, Stratford, E.—The first meeting of creditors was held on July 15th, at the London Bankruptcy Court, before Mr. D. Williams, Official Receiver. No statement of affairs was presented, but the chairman reported that the debtor roughly estimated his liabilities at £250, and disclosed no assets whatever. He had stated that he purchased the above business in October, 1921, and being employed as works manager by an electrical engineering firm, he at first carried on the business under management. In March, 1924, he sold the business for £500, and used the money in paying pressing creditors. The debtor attributed his failure to bad trade, and inability to cope with keen competition, together with heavy costs of manufacture. The case was left in the hands of the Official Receiver to be wound up in bankruptcy, the debtor further undertaking to inform the Official Receiver of the amount he would set aside from future earnings for the benefit of the creditors.

E. H. NEWMAN, and DORIS E. NEWMAN, trading as Newman and Co., radio and electrical engineers, 17, Shepherd's Bush Green, W.—These debtors again attended at the London Bankruptcy Court on July 16th, for public examination. They failed in November, 1925, with liabilities £793, against assets valued at £45, the reasons advanced being lack of capital, heavy overhead expenses, and trade depression.—Mr. Allcorn, Official Receiver, reported that the debtors had furnished the additional accounts required by the Court, and he had no questions to ask regarding them. The examination of both debtors was concluded.

R. HARRISON (lately trading with A. Mearns as The Northern Supply Co., electrical engineers, 28, Victoria Square, Bolton, electrical engineer, Yew Tree Bungalow, Hall-i'-th'-Wood, Astley Bridge Bolton.—First meeting held July 20th, at the Official Receiver's Offices, Byrom Street, Manchester. Public examination, September 21st, at the Court House, Bolton.

J. G. F. RENNIE, electrical engineer, 4, Mylen Road, and 19, Bridge Street, Andover.—First meeting held July 22nd, at the Official Receiver's offices, City Chambers, Catherine Street, Salisbury. Public examination, August 5th, at the Council House, Salisbury.

F. P. GREGORY, electrical engineer, 2a, Westbourne Road, Luton.—Last day for proofs for dividend, July 28th. Trustee, Mr. D. Helliar, Official Receiver, The Parade, Northampton.

S. PATTERSON, electrician, 42, Alexandra Park, and 55, Aberdeen Walk, Scarborough.—Receiving order made July 8th on debtor's own petition.

A. PACY, J. PACY and R. FEITELSON (trading as the Compton Wireless Manufacturing Co.), 26-28, Bartholomew Square, E.C.1. Trustee: Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2, appointed July 8th.

V. G. BAINES, electrician, 2, West Street, Wellingborough. Trustee: Mr. D. Helliar, The Parade, Northampton, released July 5th.

J. KINGSTON (trading as the Cromwell Engineering Works), electrical and general engineer, 176, Romsey Road, Southampton. Trustee: Mr. C. Hoult, Midland Bank Chambers, High Street, Southampton, released July 7th.

A. W. MATTHEWS and F. G. MATTHEWS (trading as the Electrical, Gas & Engineering Co.), 130, Main Road, Handsworth, Sheffield. Trustee: Mr. L. J. Clegg, 14, Figtree Lane, Sheffield, released July 6th.

C. E. F. PARKER, electrical engineer, Privett Road, Gosport. First dividend of 15s. in the £, payable at the Official Receiver's Offices, 87, High Street, Portsmouth.

Company Liquidations.—N. V. WEBBER & Co., LTD., electrical and radio engineers, Vale Road, Oatlands Park, Weybridge.—A meeting of creditors was held recently, at the offices of the Wireless and Radio Trades Guardian Association, New Oxford Street, W. The chair was occupied by Mr. C. Latham,

the liquidator of the company, who reported that the ranking liabilities were £731, and in addition there were fully secured creditors for £51. The net assets were £274, leaving a deficiency as regarded the creditors of £457. The company was registered on May 16th, 1925, to take over a business previously carried on by Mr. N. V. Webber as a manufacturer of experimental radio parts, &c. The original capital was £500, divided into 350 ordinary and 150 preference shares of £1 each. On March 3rd, 1926, the capital was increased to £750 by the creation of a further 250 preference shares. At the date of the liquidation the issued capital was £560. The creditors decided that the voluntary liquidation of the company should be continued with Mr. Latham as liquidator. The following are creditors :—

	£		£
Dubilier Condenser Co., Ltd. ...	24	Turner, Ernest	29
Lowenadler & Co.	20	Dew, A. J., & Co.	25
Iliffe & Sons	126	Potterton & Co.	31

SHEFFIELD WIRELESS DEPOT, LTD.—Winding up voluntarily. Liquidator, Mr. H. Cunningham, King's Chambers, Angel Street, Sheffield. A meeting of creditors was held at the Institute of Chartered Accountants, Great Swan Alley, Moorgate Place, E.C., yesterday, July 22nd. Particulars of claims to the Liquidator by July 26th.

ADVANCE ENGINEERING CO., LTD.—A meeting will be held on August 16th, at National Provincial Chambers, Silver Street, Hull, to hear an account of the winding-up from the liquidator, Mr. W. G. Hall.

H. E. DAVIS, LTD.—Meeting of creditors and contributories to be held on July 27th, at 33, Carey Street, W.C.2.

Dissolutions of Partnership.—CITY MAGNETO CO., magneto repairers, 9, Barton Street, Deansgate, Manchester.—Mr. H. Booker and Mr. E. Woods have dissolved partnership. Mr. Booker will attend to debts and continue the business on his own account.

R. WOOD & Co., dealers in oil and electrical apparatus, and general electrical engineers, 37, Westgate, Huddersfield.—Mr. A. S. Cockroft and Mr. R. Wood have dissolved partnership. Mr. Cockroft will attend to debts and continue the business under the same style.

THE RADIO REPAIR & ACCUMULATOR SERVICE, Sutton, Surrey.—Messrs. W. C. Adams and F. W. Goodwin have dissolved partnership. Debts will be attended to by Messrs. W. C. Adams and W. S. Hawkins, who will continue the business.

A Domestic Consumer's Experience.—The following is a copy of one of many testimonials regarding the operation of electric cookers and electrical apparatus generally, received by the Cooking and Heating Department of the Newcastle-upon-Tyne Electric Supply Co., Ltd.

(COPY.)

Monkseaton, *July 5th*, 1926.

"Dear Sir,

Last August my husband and I decided, when taking our new house, and after much discussion, to take electricity for lighting, heating and cooking, to the total exclusion of gas.

We have, therefore, an all-electric home.

The heating section comprises a radiator, iron, kettle, and a water-heater in the bathroom.

I must confess at the time we felt great misgivings and doubts as to what the cost of all this would be, feeling that we were, perhaps, taking on a 'little too much.'

But now, I must say, and I think it will give you pleasure to know, that we find that everything has given us the most perfect satisfaction, and the cost has been well within our original estimate.

As regards the heating section, the electric iron has proved a delightful luxury, after being used to the old-fashioned and exhausting method of ironing. And the electric kettle is very nice and handy for making a quick early morning cup of tea.

The radiator, too, is quite a comfort to use for an odd hour or so at the close of a summer's day, when it has perhaps come in a little chilly.

As regards the electric cooker, I must confess that this was the item which we decided to take with the greatest hesitation, fearing that it would prove a pleasant but costly luxury which would have to be given up after a few months. But I am now very happy to say that it has surpassed all our expectations as to efficiency, and we would not like to part with it.

The oven is delightful—simply perfect. It is so easily controlled and regulated, and gives a much better result than I have ever known by any other method.

I bake my own bread, and it is in this respect that we experience the greatest satisfaction of all, the oven turning out the most attractive and delightfully browned loaves I have ever seen, and at a cost which compares very favourably with other less efficient methods.

The grill is also very quick and satisfactory for breakfast cooking.

I would unhesitatingly recommend electricity for lighting, heating, and cooking to anyone in doubt who happened to ask my advice, knowing that if they used it as we use it, they need have no fear as to the cost.

Yours faithfully,

(Signed) ——.

To the Chief Engineer,
The Newcastle-on-Tyne Electric Supply Co., Ltd.,
Heating and Cooking Department,
Dial House,
Newcastle-upon-Tyne."

Chinese Notes.—The Wuchang Electric Light Co. is transferring its property to the King Cheng Electric Co., recently organised by the Wuchang Chamber of Commerce. The Wuchang company was formed with German capital 16 or 17 years ago, and ceased operations in March last, having sustained heavy losses. There are two power stations, an old one of 600-kW capacity and a modern one equipped with two 1,000-kW sets.

The Foochow Electric Co. is organising an electric light company in Yangkow, an important market town.

A radio-telegraph station is being erected at Tatung, Shansi Province.

A long-distance telephone service between Shanghai and Wusih (Kiangsu Province) was inaugurated in May. Further services between Kiangsu and four neighbouring provinces are under consideration.

Annual Holidays.—The works of Messrs. D. H. BONNELLA & SON, LTD., will close on the evening of July 30th until August 9th.

The works of the RECORD ELECTRICAL CO., LTD., will be closed from July 24th to August 2nd, inclusive.

Book Notices.—"Electrical Insulating Materials," by A. Monkhouse. Pp. xv + 392; figs. 112. London: Sir Isaac Pitman & Sons, Ltd. Price, 21s. net.

The Penton Publishing Co., Ltd., 2-3, Caxton House, Westminster, S.W.1, has issued a catalogue of technical works on various subjects connected with the iron, steel, and non-ferrous metal industries.

A Supplementary List (No. 2) of books on electrical engineering has been issued by the McGraw Hill Publishing Co., Ltd. This contains the titles of works by American authors, a brief review of the contents being given in each case.

Journal of the Institution of Electrical Engineers. Vol. LXIV, July, 1926. No. 355. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Condensing Plant," by R. J. Kaula, M.I.E.E., and I. V. Robinson, Wh.Sc. Pp. xiii + 400; figs. 245. London: Sir I. Pitman & Sons, Ltd. Price 30s. net.

"Alternating Currents," by C. E. Magnusson, M.S., Ph.D., E.E., third edition. Pp. xvii + 611; figs. 522. London: McGraw Hill Publishing Co., Ltd. Price 25s. net.

"The Lead Storage Battery," by H. G. Brown. Second edition. Pp. 186; figs. 96. London: The Locomotive Publishing Co. Price 5s.

Electrical Workers' Wages.—When dealing with the recent cost-of-living reduction in the wages of men employed in the electrical contracting industry (ELEC. REV., July 9th, p. 59), we stated that the reduction amounted to 26¾ per cent. This, of course, referred to the reduction from the April, 1921, figure, which is the basis of the existing agreement between the National Federated Electrical Association and the Electrical Trades Union. In order that there shall be no misunderstanding, we print below the old and new hourly rates :—

	Old rate.	New rate.
Grade A	1s. 10½d.	1s. 10d.
,, B	1s. 8¼d.	1s. 7¾d.
,, C	1s. 6¾d.	1s. 6¼d.
,, D	1s. 5¼d.	1s. 5d.

Recent Contracts.—Among the orders for electric lighting installations recently received by Messrs. Cassé & Walker, Bradford, are the following :—Ilkley: No. 3 Housing Scheme; Otley: Public slaughter houses and Otley Church Schools; Menston: Isolation Hospital buildings (also a power installation).

Social Events.—The annual outing of the employés of Messrs. Page & Miles, Ltd., electrical engineers, of Brighton, was held recently, when a party numbering 73 journeyed by road to Horsham and Guildford. Mr. E. J. Page presided at dinner at the latter town, and in proposing the health of the firm, Mr. Patching referred to the election of Mr. Miles to the presidency of the E.C.A. The guests included Mr. Penwill, secretary of the E.C.A., and Mr. W. Bowthorpe, of the General Electric Co., Ltd.

The Sheffield works of the Metropolitan-Vickers Electrical Co., Ltd., held their third annual sports meeting on July 10th. A novel feature of the meeting was an exhibition by some of the leading exponents of high and pole jumping, javelin and discus throwing. Around the sports ground were arranged various attractions in the form of coconut shies, skittles, &c., which were very well patronised. Mrs. Nelson, the wife of the manager of the works, presented the prizes at the conclusion.

B.T.-H. Magnetos in the Air.—Magnetos manufactured by the British Thomson-Houston Co., Ltd., were fitted to the aeroplanes obtaining 1st, 2nd, and 3rd places in the King's Cup race on July 9th and 10th; in fact, all the aeroplanes which completed the course were equipped with B.T.-H. magnetos. In the Special Handicap, too, the winning machine was fitted with these magnetos.

British Trade with Russia.—During the year ended September 30th, 1925, Great Britain supplied goods to the value of 110,800,000 gold roubles (over £11,000,000) to Russia, this representing 15.6 per cent. of the total imports. During the same period Russia exported to England goods valued at 185,700,000 roubles (£18,570,000), which was 32.8 per cent. of the country's total exports. Great Britain was thus the most important customer, but the United States was the principal supplier, providing 26.8 per cent. of Russia's foreign requirements.

New French Company.—A new company has lately been formed in Paris with a capital of 300,000 fr. and the title La Société de l'Energie Electrique de Taillebourg.

New Italian Companies.—Among the new electrical concerns recently organised in Italy are the Società Idroelettrica Valle Trocupia, Bologna, capital 200,000 lire, the Società Servizi e Impianti Telefonici ed Elettrici, Rome, capital 50,000 lire, and the Società Veneta Accumulatori Elettrici, Venice, capital 10,000 lire.

German Cable Syndicate.—It is reported from Essen that a syndicate of the leading German manufacturers of cables has been formed to fix prices and sale conditions as from July 1st last. The syndicate will deal with all business in Germany, Holland, and Belgium. No control will, however, be exercised in respect of the export trade with other countries.

German Cable Factory Extension.—As a result of the prevailing demand for cables, it is stated that the North German Cable Works Company, of Berlin, has decided to enlarge its cable factory so as to double the present productive capacity. Business both in telephone and power cables is said to be comparatively favourable, but sales of smaller wires and cables are hampered by the depression in the building trades.

American Contractors and Employés' Education.—The *Electragist* reports that the Philadelphia Association of Electrical Contractors and Dealers has started a three year educational course for the employés of its member firms. Each firm has deposited the sum of $50 with the Association, to be used at the discretion of an educational committee. The syllabus includes the theory of electricity, mechanical drawing, English, arithmetic, shop mathématics, illumination and sub-station design. During the course, men from the central stations, underwriters, jobbers, manufacturers, and industrial plants will be asked to give talks to the students relating to their work. The cost of the course is to be deducted from the employés' pay at the rate of $2 per week. If at the end of each year a student receives a passing mark in all studies, the whole of the amount so deducted will be refunded. In addition, cash prizes and holidays are to be awarded to the best students.

The F.B.I. and the French Debt.—The Federation of British Industries, while reserving comment on the general terms of the French Debt settlement, expresses satisfaction at one feature of the settlement, namely, the undertaking by the French Government to compensate, on approximately the same basis as French businesses are being compensated, those British businesses in France which suffered damage during the war. The Federation claims a great deal of the credit for this undertaking. It is estimated that the claims calculated on the replacement value amount to £6,500,000, and so far the only compensation received has been an *ex gratia* payment of £77,000 by the British Government.

United States Radio Production.—*Commerce Reports* states that the total exports of radio apparatus from the United States during the four years 1922-25, were valued at $22,281,000. About 35 per cent. of this went to Canada; of the remainder Argentina took 11 per cent., Australia 8 per cent., and Brazil 3 per cent. In 1925 the estimated value of production of radio apparatus was $100,000,000, and only 10 per cent. of this was exported.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. report, July 20th: Copper (electrolytic bars), no change; ditto ditto sheets, no change; ditto ditto wire rods, no change; ditto ditto h.c. wire, no change.

Messrs. James & Shakespeare report, July 6th: No change in the prices of copper bars (best selected), sheet and rod, and English pig lead.

Messrs. Edward Till & Co. report, July 6th: India rubber, Para fine, 1s. 7½d., ¼d. dec.

Lead.—Reporting under date July 17th, Messrs. James Forster & Co. state:—"Considering the difficulties created by the coal stoppage, consumption in this country is quite good, except in the electrical cable trade, where business continues to be slack. This, perhaps, is fortunate in view of the position of supplies, for it is safe to say that, had that trade been busy, an acute shortage of lead would have developed before now. As it is, there is an increasing scarcity of lead available for consumption. . . In sympathy with the market in London, the official price of lead in America has been advanced this week to 8.50 cents per lb., a rise of about 25s. per ton. The Board of Trade returns for June were:— Imports 18,741 tons, exports 2,147 tons, leaving for home consumption 16,594 tons."

The F.B.I. and Technical Education.—The Federation of British Industries has addressed a *questionnaire* to its members upon the subject of technical education. Among the points upon which information is sought are whether it is considered that the present scope of technical education should be extended to cover statistics, administration, costing, selling, and distribution; what special education is required for training for the following representative functions—the artisan, the foreman, the management and the directorate; whether there is a sufficient supply available of adequately-trained entrants for the first three of these groups; whether there is any general custom regarding facilities by firms for technical instruction for their workers; and whether in some directions technical education is keeping abreast of industry and scientific development. The circular also invites praise or criticism of the existing system.

Brazilian Electrical Profits.—According to a report issued by the income tax authorities of Brazil, the net profit on the annual turnover of the dealers in electrical supplies in that country amounts to 27 per cent.

International Tube Agreement.—The general meeting of the German Tube Union recently adopted in principle the agreement with the French, Belgian and Sarre works relating to forged iron and steel tubes up to 318 mm. exterior diameter. The agreement will remain in force until the end of March, 1930, being retroactive as from July 1st, 1926.—*Reuter's Trade Service* (Essen).

Proposed Irish Free State Tariff Commission.—The Government of the Irish Free State proposes to set up a Tariff Commission to consider applications for the renewal, modification, or imposition of import duties upon goods entering the Free State.

Australian Duty Increased.—The *Board of Trade Journal* reports that the duty upon chassis of vehicles with self-contained power, including electric vehicles, has been increased. The new rates are:—Unassembled, 2½ per cent. under the British preferential tariff, 10 per cent. under the intermediate tariff, and 15 per cent. under the general tariff; assembled, 7½ per cent., 15 per cent., and 20 per cent. respectively.

Netherlands Trade and Industry.—Mr. R. V. Laming, O.B.E., Commercial Secretary to the British Legation at The Hague, has forwarded a report on conditions in the Netherlands, dated February, 1926, to the Department of Overseas Trade (Stationery Office, 3s. net). From statistics included in the report it is seen that Great Britain, Holland's second supplier and customer (Germany occupying first place), increased her trade in both directions during 1925. Mr. Laming says that there seems to be a tendency to look more towards British sources of supply, now that a more general level of prices has been reached. The imports of electrical machinery and instruments increased during 1925 from 14,748,000 to 17,595,000 florins, and imports of boilers from 3,635,000 to 4,782,000 fl. The exports of boilers and steam engines, as well as of rolling stock for tramways and internal combustion engines, increased. The exports of glow lamps fell in value from 25,096,000 to 22,079,000 fl., while exports of electrical machinery remained almost unchanged at 2,856,000 fl. A Royal Commission report has been published on the future development of the electrification of the Netherlands, the conclusions arrived at being that centralisation in State concerns cannot be advised, but that public interest is best served by semi-public generation in districts and distribution by public or semi-public municipal distributing companies. One important industrial development in 1925 was the amalgamation of the three existing manufacturers' associations. The new Association represents 417 individual members and 38 associations of manufacturers, employing on an average 300,000 hands. The total membership of trade unions is given as 497,500. The radio service between Holland and the Dutch East Indies is progressing favourably, and the telephone service in the country is being continually improved.

Illumination of a Newspaper Office.—The accompanying illustration depicts a good example of interior illumination applied to the new offices of Allied Newspapers, Ltd., Withy Grove, Manchester. Included in the lighting equipment are ten real cast bronze pendants, supplied by the General

The Manchester Office of Allied Newspapers, Ltd.

Electric Co., Ltd., with 16-in. "Equiluxo" bowls and "Superlux" reflectors, eight 3-light brackets in real cast bronze for fixing to a grille (by Luxfer Co., Ltd.), fitted with 6-in. "Equiluxo" spheres, and five bronze radiator covers, all of which are in harmony with the decorative scheme.

Correction.—In the list of Government contracts published in our issue of June 25th, the RELIANCE ELECTRIC WIRE CO. was described as a limited company. This was incorrect, as the business is a private one.

Wages in the Engineering Industry.—The Amalgamated Engineering Union and other unions concerned in the application for an increase of 20s. per week in the wages of their members, have decided to postpone further action until "conditions are more settled."

An Italian Amalgamation.—The amalgamation is reported to be impending of the Edison Company of Milan and the Imprese Elettriche Contie, the latter of which has a share capital of 200,000,000 lire. The Edison Company is to absorb the Contie concern by increasing its share capital from 360,000,000 lire to 712,500,000 lire.

The Commercial Secretary for Mexico.—The *Board of Trade Journal* states that Mr. E. C. Buxton, who was recently appointed Commercial Secretary for Mexico, has opened offices at Calle Gante No. 4, Mexico City.

Spanish Tax on Radio Apparatus.—The Spanish Government, with the idea of restricting the importation of luxuries, has decided to impose a luxury tax of 5 per cent. for a period of twelve months from July 1st on a long schedule of goods, included in which are radio sets and apparatus.

Unemployment.—The total of unemployed persons continues to increase, and on July 5th was returned at 1,645,100. This compares with 1,639,776 on June 28th, and 1,300,350 on July 6th, 1925. The total still excludes persons who ceased work in the coal-mining industry on account of the dispute. There was a slight decrease in the succeeding week, the total falling to 1,644,300.

Lighting and Power Notes.

Bedford.—LOANS SANCTIONED.—The Electricity Committee has obtained sanction to the borrowing of £12,150 for an underground main to Sandy, £1,000 for a kiosk and transformer, £7,000 for meters and £5,000 for domestic apparatus.

EXTENSION OF SUPPLY.—In connection with the supply to Sandy and Pollor, the Committee has recommended the erection of a sub-station at a cost of £2,625.

Birmingham.—YEAR'S WORKING.—We have received from Mr. R. A. Chattock, city electrical engineer, the statement of accounts of the electricity undertaking for the year ended March 31st last. The total revenue amounted to £1,323,831, as compared with £1,182,622 in 1924-25. Working expenses decreased from £736,855 to £727,537, leaving a gross profit of £596,293 (£445,767), to which was added a grant from the Unemployment Grants Committee of £1,032, making a total of £597,325 available. Capital and other charges absorbed £413,313, and there was a net profit of £184,012, as compared with £120,370 in the preceding year. Of this, £31,000 was contributed to rate relief and £153,012 carried to renewals and special expenditure account, with a balance from the previous year of £69,937, making a total of £222,949. Works of a capital nature charged against this sum amounted to £153,316, leaving a balance, carried forward, of £69,633. The capital expenditure during the year amounted to £952,988, and was made up as follows:—Land, £1,118; buildings, £102,752; machinery and plant, £491,248; mains, £357,870. The electrical energy sold increased from 193,370,748 to 224,725,602 kWh, and the average price obtained fell from 1.468d. to 1.414d. The motor connections increased from 206,160 to 226,119 h.p., and the lamp connections in 60-watt lamps from 659,666 to 791,421.

NEW POWER STATION.—At a recent meeting of the City Council, approval was given to the proposal of the Electricity Committee to erect a new power station at Hams Hall, involving an estimated expenditure of £1,371,400.

Bolton.—LOANS.—The Electricity Committee is applying for sanction to loans of £25,000 for sub-stations, &c., £21,000 for mains, and £13,500 for plant.

Bradford.—STREET LIGHTING.—The Corporation Electricity Committee has decided to recommend that the new sub-committee, to be formed to deal with the city's street-lighting problems, should consider the advisability of substituting electric lighting for gas on the main tramway and railless-car routes. The opinion was added that this change should be made in time for the next winter.

Bromley (Kent).—ELECTRICITY SUPPLY.—The Town Council has appointed Mr. A. H. Dykes, M.I.E.E., of Beckenham, to advise it upon the question of exercising its right during the current year of resuming possession of the electricity undertaking.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—A Bill incorporating the Canadian Dexter P. Cooper Company has been approved by the Railways, Telegraphs, and Harbours Committee of the Senate. The company proposes to develop power from tidal waters in Passamaquoddy Bay, on the international boundary between New Brunswick and the State of Maine. The capitalisation is shown at $5,000,000

Ceylon.—HYDRO-ELECTRIC SCHEME.—The new hydro-electric scheme for Ceylon is now proposed to be given to a contractor for execution instead of being carried out departmentally. The work was divided into two sections—the civil engineering section and the electrical section. The first section has almost been completed by the Public Works Department, but this Department has no experience of hydro-electric work, and therefore the Government, in consultation with the Advisory Board for Hydro-Electric Projects, has given the work to private enterprise.

Continental.—BELGIUM.—According to the report of the Société d'Electricité du Nord de la Belgique for the year ending March 31st last, the company is now supplying power to 115 communes in Northern Belgium. During the 12 months 133 miles of new mains were laid, bringing the total up to 1,144 miles. The number of consumers has advanced from 42,990 to 52,371, the latter representing a load of 63,147 kW.

FRANCE.—The Société Electrique du Nord-Ouest, of Paris, has recently secured a concession to erect a 150,000-V transmission line between Dainville and Amiens, in continuation of the existing Bully-Dainville line.

Douglas (Isle of Man).—ELECTRICITY EXTENSIONS.—The Corporation has agreed to proposals put forward by Messrs. Handcock & Dykes for the extension of the electricity works involving a total cost of £77,000.

Glossop.—PURCHASE SCHEME ABANDONED.—The Corporation has abandoned the proposal to purchase the undertaking of the Urban Electricity Supply Co., Ltd.

Chesterfield.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. D. H. Davies) for the year ended March 31st last, show a total revenue of £51,610. Working expenses amounted to £24,542, leaving a gross profit of £27,068, to which was added revenue from other sources making a total of £27,802. After deducting capital and other charges, there was a net profit of £8,136, as compared with £5,472 in the preceding year. The electrical energy sold increased from 6,445,550 to 7,639,125 kWh, and the average price obtained per kWh fell from 1.64d. to 1.55d. The maximum supply demanded rose from 3,567 to 4,510 kW.

China.—TIENTSIN.—In view of the increasing demand for electricity supply, and the Governor of the city not having exercised the right to purchase the undertaking, the Compagnie des Tramways de Tientsin has decided to extend its plant by the addition of two new boilers, a 6,000-kW turbo-generator, and twelve tramcars.

Great Yarmouth.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. P. G. Campling) for the year ended March 31st last shows a total revenue of £56,416, as compared with £48,953 in the previous year. Working expenses increased from £28,180 to £29,989, leaving a gross profit of £26,428 (£20,774). After meeting capital charges there was a net surplus of £4,676, as against £2,136 in 1924-25. The capital expenditure during the year amounted to £85,622, the chief items being £20,006 for machinery, and £53,857 for mains and services. The sales of electrical energy increased from 3,145,063 to 3,956,684 kWh. Sanction has been received to a scheme for the construction of practically a new power station, having an initial capacity of 6,000 kW. The new works have been so designed that they can be extended to ultimately accommodate plant with a capacity of 40,000 kW.

Lancaster.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. G. C. Milnes) for the year ended March 31st last record a total revenue of £28,647, as compared with £26,035 in the preceding year. Working expenses amounted to £21,398, as against £20,826, leaving a gross profit of £7,249 (£5,209). After deducting capital charges there was a net profit of £1,374, of which £1,000 was contributed to the borough rate and £374 transferred to reserve. The result of the previous year's working was a surplus of £1,365. The electrical energy sold increased from 1,498,234 to 1,536,294 kWh, and the maximum load on the generating station rose from 1,526 to 1,968 kW.

London.—POPLAR.—*Year's Working.*—The annual report of the borough electrical engineer (Mr. J. H. Bowden) on the working of the electricity undertaking for the year ended March 31st last records a total income of £200,360, as compared with £204,240 in 1924-25. The working expenditure increased slightly from £115,850 to £116,675, resulting in a gross surplus of £83,685, as against £88,390, to which was added revenue from other sources, making a total of £86,880. Capital charges, &c., absorbed £72,611, and there was a net profit of £14,269, as compared with £30,933 in the preceding year. The capital outlay on the undertaking during the year amounted to £84,560. The sales of electrical energy increased from 32,537,196 to 33,356,622 kWh, and the maximum supply demanded from 14,200 to 15,800 kW. The plant capacity of the station was increased during the year from 16,000 to 26,000 kW. The average price obtained per kWh fell from 1.507d. to 1.441d.

HACKNEY.—The Electricity Committee has recommended to the Borough Council that, in view of the increased cost of coal, an increase of 10 per cent. be made on all electricity supplied during the December, 1926, and March, 1927, quarters.

HAMMERSMITH.—The Electricity Committee proposes to install two additional boilers with accessories, &c., at the electricity works, at an estimated cost of £32,201, and has recommended to the Borough Council that application be made to the Electricity Commissioners for sanction to the scheme.

North Wales.—ELECTRICITY SUPPLY PROGRESS.—According to the *Manchester Guardian*, at a meeting of the North Wales and South Cheshire Joint Electricity Authority on July 14th, approval was given to the application of the Criccieth Urban District Council for a Special Order to supply electricity to the town and district. An extension of the Crewe special

supply area to include certain parts of the rural district of Nantwich was agreed to. It was reported that the Prestatyn Urban District Council had not yet been able to settle terms with the North Wales Power Co. for the supply of electricity in bulk, and the matter was still under discussion. In the progress report of the Power Company it was stated that the main dam at Maentwrog would be completed at an early date. The excavations of the generating station at Maentwrog have been commenced, and the generating plant is under construction, delivery being expected at the end of the year.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

TORQUAY.—To business and private premises supplied under the combined rate, the standing charge reduced by 10 per cent. To consumers under the combined system who do all their cooking by electricity, the "unit" charge reduced from 1d. to ½d., with a discount of 10 per cent.

TONBRIDGE.—Lighting and power: A reduction of ¼d. per kWh.

Richmond-on-Tees.—ELECTRICITY SUPPLY.—In connection with the electricity scheme, the Town Council has fixed the charge for electricity for lighting at 8d. per kWh, and for power at 4d. A loan of £11,500 is to be obtained.

Sandwich.—ELECTRICITY SUPPLY.—The Town Council has sold a site to the South-East Kent Electric Power Co., Ltd., for the erection of a transforming station. The company will commence laying cables in October, and will supply electricity at 8d. per kWh for lighting, and 3d. per kWh for power.

South-East Lancashire Electricity Advisory Board.—ALTRINCHAM.—The Engineering Advisory Committee has considered a proposal of the Altrincham Electric Supply, Ltd., to install an additional 40,000-lb. water-tube boiler at an estimated cost of £14,500, and has resolved that the scheme be approved.

ASHTON-UNDER-LYNE.—The Committee has received details from Manchester Corporation of the cost of providing a bulk supply to Ashton-under-Lyne, and has also received particulars from the latter authority giving comparative costs of extensions for local generation and bulk supply. The Committee has requested Ashton Corporation to prepare further details of local generation, plus bulk supply, on the assumption that its station would be shut down at week-ends and nights.

MANCHESTER.—The Corporation has applied for sanction to a loan of £234,000 for mains, &c., and has requested the Board to sanction a part of the scheme estimated to cost £88,620. It is also proposed to extend Barton power station at an estimated cost of £600,000, made up as follows:—Buildings, £175,000; plant (including one 40,000-kW turbo-alternator, two 35,000-kVA transformers, and two 130,000-lb. water-tube boilers), £425,000. The Committee has recommended to the Board that the extensions be approved.

CHAPEL-EN-LE-FRITH.—The Committee has resolved that the Board be recommended to support the application of the Power Development Co., Ltd., for a Special Order covering Chapel-en-le-Frith and district.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Pooley Hall Colliery Co., Ltd., for the supply of electricity in the rural district of Tamworth, and parts of the rural districts of Atherstone, Ashby-de-la-Zouch, and Market Bosworth; the Torpoint Electric Supply Co., Ltd., to supply in the urban district of Torpoint, the borough of Saltash, and the rural district of St. Germans.

The Commissioners have submitted to the Minister of Transport for confirmation, Special Orders made by them authorising the Brynammen & District Electric Supply Co., Ltd., to supply electricity in the urban district of Cwmamman and parts of the rural districts of Llandilo Fawr and Pontardawe; Norwich Corporation to supply in the urban district of North Walsham, and parts of the rural districts of Aylsham, Blofield, Forehoe, Henstead, Loddon and Clavering, Mitford and Launditch, St. Faith's, Smallburgh and Wayland; Mr. J. A. Purves to supply in the urban district of Bampton.

Stirlingshire.—ELECTRICITY SUPPLY.—An offer by the Scottish Midlands Electric Power Company to supply electricity to a number of villages where housing schemes are being carried out, has been accepted by the Eastern District Committee of the County Council.

Stretford.—YEAR'S WORKING.—The accounts of the Urban District Council's electricity undertaking (engineer: Mr. T. A. Kerr) for the year ended March 31st last record a total income of £197,648, as compared with £179,459 in 1924-25. Working expenses amounted to £120,599, as against £107,422, leaving a gross profit of £77,048 (£72,037). After deducting capital charges, there was a net surplus of £21,713, as compared with £20,844 in the preceding year. The capital expenditure during the year amounted to £44,968, the chief items being £23,426 for machinery and £19,292 for mains and services. The consumption of electrical energy increased from 41,537,503 to 49,301,069 kWh, and the maximum supply demanded from 15,409 to 16,890 kW.

LOAN.—The Electricity Committee is seeking sanction to a loan of £45,000 for electricity purposes.

Watford.—LOANS.—The Electricity Committee is applying for sanction to loans of £30,000 for mains and services, and £9,000 for the proposed ring main from North Watford to Oxhey.

Weymouth.—ELECTRIC COOKERS.—The Town Council having applied for a loan of £2,500 for the purchase of electric cookers, the local gas company has asked the Electricity Commissioners to withhold sanction to the loan until a local inquiry has been held and the views of the ratepayers heard upon the matter. The Council has forwarded to the Commissioners a statement showing that during the past year 54 electric cookers were let on hire; there are now applications for 30 cookers, and it is anticipated that during the next three years the demand will have risen to 200 cookers.

York.—YEAR'S WORKING.—The report on the working of the city electricity undertaking (engineer: Mr. E. J. Nichols) for the year ended March 31st last shows a total income of £105,878, as compared with £100,889 in the preceding year. Working expenses amounted to £58,772, as against £56,752, leaving a gross profit of £47,106 (£44,136). After deducting capital charges there was a net profit of £18,366, as compared with £13,186 in 1924-25. A contribution of £2,268 was made to the borough fund. The capital expenditure during the year, which included £56,378 for machinery and £31,220 for mains and services, amounted to £90,733. The sales of electrical energy increased from 14,947,464 to 17,454,837 kWh, and the maximum supply demanded from 6,627 to 7,559 kW. The average price obtained per kWh fell from 1.62d. to 1.41d.

Tramway and Railway Notes.

Continental.—ITALY.—A Government Commission has now completed its plans with regard to the proposed construction of a network of underground electric railways in Rome while at the same time preserving the ancient architectural features of the city. It is estimated that a period of ten years will be required to establish the first network comprising two main lines, which will then gradually be followed by other lines, including a circle railway around the south of Rome.

BELGIUM.—The Société Nationale des Chemins de Fer Vicinaux has just completed and opened for traffic a further section of its electrified line between Binche and Anderlues.

East Ham.—YEAR'S WORKING.—The report on the working of the Corporation's tramway undertaking (manager: Mr. W. R. Elliott) for the year ended March 31st last shows a total income of £86,160, and working expenditure of £98,830, leaving a gross deficit of £12,670. The previous year's figures were:—Income, £81,292; working expenses, £96,061; gross loss, £14,769. The gross deficit was carried to net revenue account, together with a net loss from the previous year of £42,889. The latter deficit was met by a contribution from the borough fund, and after deducting capital charges there was a net loss of £39,513. The car mileage increased from 1,568,102 to 1,626,835, but the number of passengers carried decreased from 15,987,284 to 15,630,477, resulting in a reduction in the total revenue per car mile from 12.33d. to 12.28d.

Glasgow.—YEAR'S WORKING.—We have received from the general manager of the Corporation tramways (Mr. J. Dalrymple) a copy of his report, together with the statement of accounts, for the year ended May 31st last. This shows a decrease in the revenue from £2,352,470 to £2,263,107. There was also a reduction in working expenses, however, from £1,746,000 to £1,653,526, the gross profit showing a slight increase at £609,581, as compared with £606,470, to which was added interest on investments amounting to £50,334, making a total of £659,915 available. From this the following charges had to be met:—Interest, £99,609; sinking fund, £55,946; property and income tax, £79,486; depreciation and permanent-way renewals fund, £526,753; Parliamentary expenses, £1,114. The net result, therefore, was a deficit of £102,992. The subway section of the undertaking showed a revenue of £96,826, against which was charged working expenses £101,519, and capital charges, resulting in a deficit of £25,562. There was also a loss on the motor-omnibus system, and the result for the whole of the undertaking was a deficit of £137,851, as compared with a loss in the preceding year of £80,976. The amount spent on capital account amounted to £168,033, bringing the total up to £6,668,240. The year's expenditure included £77,210 on permanent way and £59,853 on the electrical equipment of the lines. The car-mileage increased from 30,937,196 to 32,058,534, but there was a falling off in the number of passengers carried from 439,340,730 to 425,478,213, with a consequent decrease in the average receipts per car-mile from 18.22d. to 16.91d. The consumption of electrical energy increased by 3,219,583 kWh to 54,544,019 kWh.

London.—UNDERGROUND SERVICES IMPROVEMENTS.—The Metropolitan Railway has resumed its complete business electric train services to and from Baker Street and City stations with its extension line stations, which include Willesden Green, Harrow, Uxbridge, Rickmansworth, and Watford. The Circle service has been improved by the pro-

vision of longer trains, and the Hammersmith and New Cross service has also been strengthened, and the full service resumed on the G.N. and C. section of the line between Finsbury Park and Moorgate.

MORDEN TUBE PROGRESS.—The whole of the permanent way of the new 5-mile tube from Clapham to Morden is laid, and the system of cables has been installed. The car depôt at the Morden terminus is finished and most of the new cars are delivered and ready for use. This rolling stock is of the latest type and similar to that now in use on the Hampstead and City railways. It will be possible to travel by tube from Morden to Edgware—a distance of 21¼ miles—the longest tube run in the world. It was anticipated that the Morden extension would open during the present month, but the coal dispute will cause an unavoidable postponement to be made. It is hoped, however, that the opening will not be delayed for more than a few weeks.

GREENWICH POWER STATION.—The Highways Committee of the L.C.C. has recommended that three new boilers be substituted for six old boilers at the Greenwich power station. The cost of the scheme is estimated at £131,500.

TRAMCAR IMPROVEMENTS.—The Highways Committee of the L.C.C. has also recommended that improvements be made in 100 of the Council's tramcars, including the provision of cushions, signal bells with four pushes for the use of passengers, rearrangement of seating, and a new scheme of interior and exterior decoration. The cost is estimated at £23,300.

Manchester.—TRANSPORT CONGESTION REPORT.—According to *The Times*, the Traffic Congestion Committee of the City Council has requested the tramways manager to report on the suggestion that tramcars should be withdrawn from the congested area. It is understood that a number of important suggestions have been put forward to the Traffic Congestion Committee, including:—(1) The withdrawal of all tramcars from the centre of the city; (2) the introduction of motor-omnibuses in the centre of the city; (3) the introduction of a one-way traffic system; (4) that no tramcar should enter the city beyond the railway stations; (5) the introduction of underground railways from railway stations; and (6) the use of motor-omnibuses in a given radius to connect up with long-distance tramcars.

Telegraph and Telephone Notes.

Belgium.—TELEPHONE AND TELEGRAPH REORGANISATION SCHEME.—The Cabinet has been considering a Telephone and Telegraph Administration Bill which will give the Government power to form a national telephone and telegraph company. The Bill is said to be drawn up on the same basis as the recent measure for a national railway company, many articles in the two Bills being identical. The capital of the new company will amount to 1,800,000,000 francs, and it will issue three million preference shares of 500 francs each; ordinary shares will resemble those of the railway company and State property; 30 per cent. of the sum realised by the issue of preference shares will be handed over to the Telephone and Telegraph Company in order to assure the execution of the plan for the extension of the telephone service contemplated by the Minister for Railways.—*Reuter* (Brussels).

China.—TELEGRAPHIC DELAY.—The prevailing state of affairs in China is indicated by the Great Northern Telegraph Co.'s notice of July 15th of indefinite delay to messages to Tientsin and beyond. Telegraph communication with Peking had then been totally interrupted, while that with Tientsin had been restored on a weak line. Communication was restored on the 19th inst.

Greece.—NEW CABLES.—A decree law published on July 13th, says the *Daily Telegraph*, ratifies the convention recently signed between the Greek Government and the Eastern Telegraph Co. whereby the latter obtains an extension of its concession for transmitting all messages by cable and wireless from Greece to other countries during a period of 30 years. Besides a reduction of 50 per cent. on all Government messages, the company undertakes to lay new cables between Corfu and Sayada, between Syra and Tenos, and between Myconos and Ikaria, and to keep in good repair the cables owned by the Greek Government for £5,000 per year compensation. The company undertakes also to install within 12 months in Athens an up-to-date wireless station for communication with foreign countries, with a minimum radius of 2,500 kilometres.

Portugal.—CABLE COMMUNICATION.—A definite contract has been signed between the Portuguese Government and the Campanhia Dei Cavi Telegraphici Sotto Mari Italcable for the establishment and working of the submarine telegraph cables between Fayal (Azores) and S. Vicente (Cape Verde), between Fayal and Italy, and between Lisbon and Malaga.—*Reuter* (Lisbon).

Sweden.—TELEPHONE AND TELEGRAPH SERVICES.—The Department of Overseas Trade informs us that, according to the annual report just published by the Swedish Telegraph Administration, the number of telephone apparatus in use throughout the country in 1925 amounted to approximately 434,594, or about 72 instruments to every 1,000 inhabitants (Stockholm 282 per 1,000 inhabitants). The total number of conversations recorded amounted to 640,318,200 in 1925, compared with 609,843,400 in 1924, showing an increase of 5 per cent. The number of subscribers to the State system also increased from 338,187 to 352,722. The number of individuals employed in the Telegraph Administration totalled 15,041 (including 9,800 women), being an increase of 218 compared with 1924. At the end of the year there were 4,593 telephone stations in Sweden, compared with 4,477 at the end of 1924, and the total length of the State conductors amounted to 817,162 kilometres; telegraph lines totalled 44,850 kilometres (excluding railways). At the end of 1925 there were 3,604 telegraph stations in Sweden, compared with 3,566 in 1924. The number of wireless telegraph installations on board ships in 1925 amounted to 296; the number of telegrams handled in 1925 amounted to 17,193,931, compared with 16,580,444 in 1924. The gross receipts of the Telegraph Administration were, from telephones: kr. 69,397,629; from telegraphs: kr. 7,938,486; from rents: kr. 2,315,350; from wireless: kr. 2,033,703. Total, kr. 81,685,168.

Radio Notes.

Denmark.—GOVERNMENT SERVICE.—According to *Commerce Reports* the Rigsdag has authorised the establishment of Government broadcasting stations to operate under the direction of the Minister of Traffic, assisted by a radio council of nine members. Listeners are to pay fees, which will be applied to broadcasting after the expenses of the telegraph authorities have been met.

Egypt.—NEW RADIO REGULATIONS.—A recent decree regulates the sale and use of all radio apparatus in Egypt. It includes many features of the British law, particularly the matter of patent infringement by builders of home-made sets.

Germany.—LICENCES.—At the end of April last 1,205,310 wireless receiving licences were in operation in Germany, as compared with 1,184,236 at the same period of 1925, an increase of 21,074 during the twelve months. Berlin has the largest number of listeners (522,461), Hamburg following with 155,214, and Leipzig with 124,064.

Holland.—REOPENING THE HAGUE STATION.—With reference to the note under the above heading in our issue of June 25th, 1926, page 962, the Department of Overseas Trade (our source of information) informs us that the words "the wireless station closed down in 1921 owing to the bankruptcy of Mr. Idzerda," were a mis-statement. Mr. Idzerda points out that he personally was not declared bankrupt, but that it was the company of which he was the managing director, *viz.*, the N. V. Nederlandsche Radio Industrie, which defaulted. A new concern was established on December 2nd, 1925, under the style of the N. V. Idzerda Radio, and this company took over the premises and machinery of the bankrupt concern. Mr. Idzerda states that most of the shareholders of his previous company are now participating in the new concern. The Department desires to express its regret for the error.

Irish Free State.—NEW STATIONS.—In the Free State Senate, on July 6th, Mr. J. J. Walsh, Minister for Posts and Telegraphs, said it was deemed necessary to have a high-power central station (in addition to four smaller stations) to serve crystal sets within a radius of seventy to eighty miles. The erection of the small stations would take place without delay. The Dublin station was working well. The Cork station would be put up within the next few months, and they hoped to follow that with stations in Galway and the North-West within the next eight or ten months, but it would take anything up to eighteen months or two years to complete the h.p. station. The small stations would cost eight to nine thousand pounds each to erect, and the high-power station something like forty thousand pounds. The running cost was £21,000 in the current year for Dublin, and would be smaller for the Cork and Bundoran North-West station. In the case of Galway, they had in mind a separate service, because of its location in the Gaeltacht. In any case, the smaller stations would cost about forty thousand pounds a year, including repayment of principal and interest. In addition to that sum there would be, possibly, a similar sum for the h.p. station when working. Apart from the capital, which would not fall far short of eighty or ninety thousand pounds, the State would have to make an annual contribution, either through licence fees or through revenue from import duties, or from some other source, amounting to sixty or seventy thousand pounds. Out of 25,000 owners of sets estimated now in the country, only 5,000 had taken out licences since the beginning of the financial year.

Netherlands India.—BROADCASTING CONCESSION.—It is reported in *Commerce Reports* that the Government is considering the granting of a 10-year broadcasting concession to a private concern. Monopoly will be maintained, and the right to withdraw the concession will be reserved. All receiving sets will be licensed, the annual fee being 25 guilders, plus a service charge. No monopoly for the sale of receiving sets will be established.

Nova Scotia.—BROADCASTING CONTEMPLATED.—Plans are being made for the installation of a broadcasting station in Halifax, local associations and enterprises having agreed to subscribe toward the cost.

Wave-lengths.—COMING CHANGES.—A new, and what it is hoped will prove a permanent, system of international broadcasting wave-lengths has been decided upon and will come into force in the second week in September, said Capt. P. P. Eckersley, chief engineer of the British Broadcasting Co., at a luncheon given in London in honour of Prof. L. A. Hazeltine, the American wireless expert, who is referred to in our "Personal Notes."

Lt.-Col. Eric Ball, proposing the toast of "The B.B.C.," said that whatever changes were made in its constitution, he hoped that the executive staff would be kept on as at present. They were watching events, and hoped to get a copy of the Bill so that those in the industry could bring pressure on members of Parliament to secure any alterations which might be deemed necessary.

Capt. P. P. Eckersley, in reply, said there should be no great fear regarding change of the constitution of the B.B.C., and he was perfectly certain that the staff would go on. He had just returned from a meeting in Paris of the International Radiophone Union, at which a new plan of wave-length changes was decided upon. The system was that the less important broadcasting stations would work on common wave-lengths, while the important stations would have exclusive wave-lengths. British broadcasting stations had been allotted 10 exclusive wave-lengths. In some cases there would probably be a change of 50 metres one way or the other. The new plan had been agreed upon by 90 per cent. of the nations of Europe; although it would bring a certain dislocation to some listeners, there would be less interference from stations abroad than heretofore. With regard to finance, Capt. Eckersley said there was absolutely no question that the efficiency of the broadcast service was only in proportion to the amount of money that could be spent upon it, and the shortcomings of the B.B.C. were largely due to the fact that they had not got enough money. He hoped the Government would put the Committee's recommendations into operation as soon as possible.

Capt. Ian Fraser, M.P., proposed "The Industry," and said he had no doubt that under the new arrangements progress would be made to the benefit of the country, and the trade as well. In 1922 the value of imports of wireless apparatus amounted to £57,000. In 1925 the figure was £634,000. Valves, which were listed separately, were imported in 1922 to the extent of £26,000, but in 1925 the figure had grown to £134,000. The export figure for wireless apparatus in 1922 was £341,000, as against £1,100,000 in 1925. The last figure included a certain value of component parts which were not included in the former figures, but even allowing for that it represented a very substantial increase. The export of valves in 1922 was £39,000, and in 1925 £183,000. The export figures showed that the wireless industry in this country could congratulate itself on the progress it had made.

Lieut.-Commander Kenworthy also spoke, remarking that compared with the population of America, there were more wireless sets per family in this country than in America. He pleaded for those in the industry to keep in touch with members of Parliament as to what was going on. Their views would be of great value to the members.

Mr. Joseph Joseph, in reply, said that the invention so closely associated with the name of Prof. Hazeltine had enabled American manufacturers to get down to a mass production stage. Apparatus in America was practically standardised, and certainly gave the American manufacturer a great advantage over the British trader. He would like to see something similar happen in this country. One of the curses of the industry here was variety, the continually changing designs of apparatus. He doubted whether many manufacturers of sets were working at a profit at the present time. He believed that if the recommendations of the Committee were carried into effect it would give an enormous impetus to trade.

United States of America. — "NEUTRODYNE" PATENTS UPHELD.—Federal Judge Thacher, on July 2nd, upheld the "neutrodyne" patents of Prof. Louis A. Hazeltine. The decision, it is believed, will affect many manufacturers of radio receiving sets, as a ruling in the Federal Court in Brooklyn earlier had held that the "Hazeltine idea" was being employed in a "substantial portion" of the present output of radio sets. The owners of the patents have issued "neutrodyne" licences to various radio manufacturers on a five per cent. royalty basis.

REGULATION BILL.—The Dill Bill to set up an independent commission to regulate the radio-broadcasting industry was passed on July 2nd by the Senate.—*Reuter's Trade Service* (Washington).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—August 23rd. Electricity Commission of Victoria. 10-in. disk suspension insulators. (July 2nd.)

July 26th. 22,000-V porcelain bushing insulators. (July 9th.)

September 1st. Victorian Government Railways. Automatic sub-station equipment for Elwood sub-station. (B.X. 2598.)*

August 11th. City Council. H. and l.p. 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

August 10th. Telephone exchange indicators. (B.X.2597.)*

August 31st. Telegraph equipment. (B.X.2653.)*

September 21st. Switchboard keys and parts. (B.X.2669.)*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Belfast.—July 31st. Electricity Department. One 15,625-kW turbo-alternator with condensing plant and auxiliaries, or, alternatively, one 18,750-kW turbo-alternator with condensing plant and auxiliaries. (July 2nd.)

Bridlington.—August 6th. Electricity Works. One 600-kW surface condenser with extraction plant and circulating pump, pipework, and valves. One wooden cooling tower, with tank and foundations. (July 16th.)

Coventry.—September 3rd. Electricity Department. Buildings, foundations and subways, two 15,000-kW turbo-alternators, condensing plant and auxiliaries, water-tube boilers, complete with accessories, coal- and ash-handling plant, switchgear, pipework, crane, and cooling towers. (See this issue.)

Egypt.—CAIRO.—October 15th. Ministry of the Interior. Installation of electric power station equipment at Keneh and Luxor. (B.X.2627.)*

August 2nd. Director-General, Mechanical Department, P.W.M., Cairo. 400-b.h.p. Diesel engine, driving an air compressor, together with auxiliary machinery.

Denmark.—AARHUS.—August 17th. Lighting Department. Steam turbo-generator and boiler plant. (A.X.3371.)*

India.—August 9th. India Store Department. Electrical generating plant for the Peshawar power station of the North-Western Railway. (B.X.2544.)*

September 10th. Switchgear and auxiliary plant in connection with G.I.P. Railway electrification. Forms of tender (20s.) from the above.

Kilkeel.—August 5th. Rural District Council. Cold-starting crude oil engine, generator, booster and switchboard, storage battery, pole erection work, line erection work, erection of power house. (July 9th.)

London.—EETHNAL GREEN.—July 29th. Board of Guardians. Installation of an internal telephone system at the Children's Homes, High Road, Leytonstone. Forms of tender (£2 2s.) from Mr. C. Faulkner Jones, clerk to Guardians, Bishop's Road, London, E.2.

H.M. Office of Works. July 28th. Wire and cable. (July 16th.)

August 23rd. County of London Electric Supply Co., Ltd. Supply and erection of a central evaporating equipment. (See this issue.)

Manchester.—July 26th. Electricity Committee. One 500-kVA static transformer. (July 9th.)

August 4th. 12 months' supply of electric cooking ranges. (July 16th.)

Newark.—August 12th. Waterworks Department. One 200-kVA oil-cooled static transformer and 11,000-V switchgear cubicle. (See this issue.)

New Zealand.—CHRISTCHURCH.—October 19th. Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X.3215.)*

WELLINGTON.—August 24th. Public Works Department. Synchronous condensers for the Waikaremoana electric power scheme. (B.X.2608.)*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

September 28th. Three electrically-driven low-lift pumps, with control apparatus, for the Taleri drainage. (A.X.3274.)*

November 2nd. Electric generators and turbines for Waikaremoana electric power scheme. (B.X.2622.)*

Indoor control gear and switchgear in connection with the Waikaremoana electric power scheme. (B.X.2675.)*

September 7th. Synchronous condenser for the Arapuni electric power scheme. (B.X.2654.)*

August 10th. Postmaster-General's Department. Dry cells. (B.X.2649.)*

DUNEDIN.—September 8th. City Council. One reaction waterwheel, with governor and valves, &c., one 3,000-kW generator, four 1,000-kW transformers, switchboards, oil-break switches, voltmeters, &c. (B.X.2676.)*

Salford.—July 26th. Board of Guardians. Extension of electric lighting installation at Poor Law Offices, Eccles New Road. Specification from Mr. E. H. Inchley, clerk to the Board, Poor Law Offices.

South Africa.—August 12th. South African Railways and Harbours. Electric cables and wires and bare copper wire (for 12 months). (B.X.2639.)*

Installation of electro-pneumatic power working of points and day colour-light signalling, with a.c. track circuits. (See this issue.)

August 26th. Material for the distribution system, Capetown suburban electrification. (B.X.2680.)*

JOHANNESBURG.—July 29th. Municipal Council. Transformers. (B.X.2636.)*

August 18th. Overhead tramway equipment. (B.X.2702.)*

Spalding.—July 29th. U.D.C. Mains and kiosks. (July 9th.)

Stewarton (Ayrshire).—July 29th. Town Council. Electric lighting at housing scheme. Plans with the architect, Mr. W. F. Valentine, 5, John Dickie Street, Kilmarnock; offers to Town Clerk.

Stoke-on-Trent.—September 7th. Electricity Department. One 10,000-kW turbo-alternator and condensing plant. One natural-draught cooling tower. Ironclad l.p. 3-phase switchgear. (See this issue.)

Waterford.—July 29th. Borough Council. E.h.p. overhead lines distribution network and street-lighting system. (July 2nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Closed.

Australia.—SYDNEY.—New South Wales Railways. Accepted :—

2,500-kW turbo-alternator (£12,788).—Australian General Electric Co., Ltd.
Two water-tube boilers and stokers (£19,084).—John Thompson (Aust.) Pty., Ltd.
Five miles 50 pair lead-covered telephone cable (£3,265).—Enfield Cable Works (Aust.), Ltd.
—*Tenders.*

Carlisle.—Electricity Committee. Accepted:—

Two 500-kVA transformers (£856).—Brush Electrical Engineering Co., Ltd.
Portable coal conveyor (£200).—C. H. Johnson & Sons, Ltd.

Chesterfield.—Electricity Committee. Accepted:—

700 yd. l.p. cable.—Standard Telephones and Cables, Ltd.

Croydon.—Electricity Committee. Accepted :—

Erection of sub-stations at Thornton Heath (£241) and Bingham Road (£369).—W. Waller.

Atmospheric exhaust piping.

Mechans, Ltd. (Accepted.)	**£142**
Babcock & Wilcox, Ltd.	170
Stewarts & Lloyds, Ltd.	178
T. Piggott & Co., Ltd.	199
Alton & Co., Ltd. (late tender)	182

Recommended :—

Electric coal-handling crane (£1,244).—S. Butler & Co., Ltd.
Crane truck (£350).—R. N. Neal & Co., Ltd.

Dorchester.—Electricity Committee. Accepted:—

360 yd. cable (£267).—Johnson & Phillips.

East Ham.—Electricity Committee. Accepted:—

Tubular cooler (£380).—Worthington, Simpson & Co., Ltd.

Gravesend.—Electricity Committee. Recommended:—

Switchgear (£503).—British Thomson-Houston Co., Ltd.

India.—GREAT INDIAN PENINSULA RAILWAY. Accepted :—

Arc welding electrodes for six months.—Alloy Welding Processes, Ltd.

BOMBAY, BARODA AND CENTRAL INDIAN RAILWAY. Accepted :

1,346 TG 13 type train-lighting cells, 180 Ah each.—Fuller's United Electric Works, Ltd.

Irish Free State.—DUBLIN.—Great Northern Railway Co. (Ireland).

Drawn wire lamps.—Edison Swan Electric Co., Ltd.

Kendal.—Town Council. Accepted:—

Supply and installation at Lound Gardens of an 800-Ah battery at £3,431, less 5 per cent.—The Alton Battery Co., Ltd.

London. — HACKNEY. — Electricity Committee. Recommended :—

Supply and erection of pipework and valves required in connection with a 10,000-kW turbo-alternator (£2,353).—Stewarts & Lloyds, Ltd.

AIR MINISTRY.—

Accumulators.—Edison Swan Electric Co., Ltd.

Margate.—Town Council. Accepted:—

Electric light at houses on the Dane Valley Estate (£5 8s. per house).—E. A. Pinto.

Portsmouth.—Tramways Committee. Tram rail material. Accepted :—

Hadfields, Ltd. (Accepted.)	**£1,286**
Edgar Allen & Co., Ltd.	£1,355
Titan Trackwork Co., Ltd.	£1,360

Swansea.—Education Committee. Accepted :—

Electrical installation at Manselton School (£340).—James Eade & Son.
Electrical installation at Terrace Road School (£265).—T. Ventura.

Tynemouth.—Electricity Committee. Accepted:—

Cable (£1,934).—Standard Telephones and Cables, Ltd.

Notes.

R.E. Luncheon to Civilian Engineers.—A very pleasant function was held at the Royal Engineer Barracks, Chatham, on July 16th, when a number of heads of engineering firms, consulting and other civilian engineers, were entertained at luncheon by the Commandant, School of Military Engineering, Chatham, Maj.-Gen. Phillip Gordon Grant, C.B., C.M.G., and the officers of the Royal Engineers. The object of the luncheon was to show the appreciation of the military engineers of the assistance rendered by the civilian members in the education of engineering officers by allowing them to undergo special training in electrical and mechanical engineering in industrial workshops, and so to get an insight into all the branches of engineering, which might be put at the service of the country in a time of war. The guests assembled at Charing Cross Station, and were received at the R.E. Mess House, Chatham, by Maj.-Gen. H. F. Thuillier, C.B., C.M.G., Director of Fortifications and Works. A considerable number of R.E. officers were present, and a very fine luncheon was enjoyed by the party. After the usual toasts, Gen. Thuillier addressed some very complimentary remarks to the firms represented for the service they had rendered to the country. Col. R. E. Crompton, as the oldest of those present, answered for the visitors and recalled many happy visits of the same kind which he had made during the past 20 years. He was much "chaffed" as the result of his confession that he had on one occasion of a visit, the object of which was to train young R.E. officers, spent more time in playing rackets than in imparting knowledge to his students. The visitors were, after luncheon, shown round the museum, where many interesting army relics are kept, including a field map used by the Duke of Wellington at Waterloo, and similar maps used by General Gordon in the Chinese War against the rebels. Pink spots on one of the maps were said to be the marks made by Gen. Gordon's wounded finger. Everybody was interested in what he saw, and Col. Crompton pointed out the steep point of ascent at Brompton Barracks where the first steam tractor used by the sappers for giving power in the field was tested. Visits were also made to the war memorials, and after tea the guests left Chatham much impressed with the instructive day they had had.

Women's Engineering Society.—The fourth annual conference of the Women's Engineering Society is to be held at Leeds University, from September 3rd to 6th next. Apart from the reading of papers, which will include one on "Portable Electric Tools, With Some Newer Developments," by Mrs. M. L. Matthews, a number of works visits have been arranged for.

Appointments Vacant.—Mains foreman for the Wrexham Corporation Electricity Department. Technical assistant for Cheadle and Gatley Urban District Council Electricity Department. Mechanician required by the Government of Nigeria for the Posts and Telegraphs Department. (See our advertisement pages to-day.)

The London Joint Electricity Authority's Finance.—The London County Council has been asked by the London and Home Counties Joint Electricity Authority whether it would be prepared to agree in principle to guarantee the payment of the interest on a sum of £1,000,000 to be borrowed by the Authority. The matter has been considered by the Council's Finance Committee, which reports that the Council has power under the Electricity (Supply) Act, 1922, to lend money to the Authority, to subscribe for securities issued by the Authority, or to guarantee the payment of interest on loans. The Committee considers that the financial risk of guaranteeing the interest would presumably not be serious, as the interest should, in the course of time, be secured by the revenue obtainable by the Joint Authority. It therefore recommends that the principle of the Council giving a guarantee in respect of the payment of interest on a sum of £1,000,000 to be borrowed by the Authority be agreed to, on the understanding that any such guarantee shall be conditional upon an assurance being obtained in due course from the Electricity Commissioners that they are satisfied that the technical scheme in respect of which the money is to be borrowed is considered by them to be the best that can be devised for securing a satisfactory supply of electricity at the cheapest possible rate.

Educational.—UNIVERSITY COLLEGE, SWANSEA.—Particulars concerning admission to the courses in Civil, Mechanical, and Electrical Engineering and Metallurgy, and of the entrance scholarships to be offered for competition in September next, can be obtained from the Registrar, Singleton Park, Swansea.

Fatality.—On July 15th a boy, aged four years, climbed a fence at Eltham and walked over the live rails of the Southern Railway system. He came into contact with one of them and was killed instantly.

A New Artificial Silk Factory.—On July 15th Messrs. British Visada, Ltd., opened a new works which they have established for the manufacture of artificial silk at Python Mill, Littleborough, Lancs. The project is considered an important development in the artificial-silk industry; the capital invested amounts to £360,000. The factory is being equipped with up-to-date production machinery and a modern electric power plant installed by the Metropolitan-Vickers Electrical Co., Ltd. This plant, in the design of which special attention was given to the provision of exhaust steam for the processes in the mill, consists of a 1,000-kW M.V. standard turbine geared to a 3-phase, 440-V alternator of the same capacity, and a smaller turbine and alternator of 100 kW capacity. The steam is supplied from four Lancashire-type boilers. At the opening ceremony the turbines were started up by Lady Stockton and Mrs. Turner. Sir Edwin Stockton, chairman of the company, in calling upon these ladies to perform their tasks, said that the new concern was the first real British artificial silk undertaking to be established. The plant throughout was British and the scheme was an effort towards solving the unemployment problem. When the mill was in full production it was hoped to turn out 27,500 lb. of material per week. He congratulated the contractors on the satisfactory manner in which they had installed the plant. It was important to remember that the artificial silk industry was not in opposition to the silk industry but would help it. Colonel Dobson, of Messrs. Dobson & Barlow, Ltd., who supplied the factory plant, and Mr. J. C. Whitmayer (Metropolitan-Vickers) replied on behalf of the contractors. Mr. Whitmayer said the saving expected from the power plant over the cost of a supply from the public

mains was about £10,000 per annum on full output. Mr. Whitmayer presented Lady Stockton and Mrs Turner with two onyx boxes on behalf of the Metropolitan-Vickers Co.

Royal Air Force Apprenticeships.—The Air Ministry announces that five hundred aircraft apprentices are required, between the ages of 15 and 17, for entry into the Schools of Technical Training, Halton, Bucks., and Flowerdown, near Winchester. Selection will be made from candidates by examination. Full particulars can be obtained from the Secretary, Air Ministry, Kingsway, W.C.2.

Congress of Chemists.—The Society of Chemical Industry was founded in 1881, and numerous sections have been organised at home and overseas; the present membership is about 5,000. The Congress of Chemists, which is being held in London (July 19th to 23rd) in connection with the Society's annual meeting, is probably the most representative ever organised in this country. Associated with the Society are sixteen societies and institutions interested in pure or applied chemistry; the number of delegates is about 800, and representatives of various foreign and oversea scientific organisations are present.

Besides social functions, excursions, &c., the works visited include the General Electric Co.'s Osram Robertson Lamp Works, and its glass works and research laboratories, whilst the National Physical Laboratory was also inspected. Many papers have been read and discussed, and the British Chemical Plant Manufacturers' Association seized the opportunity to organise the first London exhibition at the Central Hall, Westminster, devoted solely to British chemical plant and plant constructional materials. Forty firms took space, and some idea of the comprehensive nature of the exhibition may be gathered from the fact that there are over 200 different types of exhibit, the total number of exhibits being three or four times as many.

The Institution of Electrical Engineers.—The result of the ballot for the election of members of Council for the year 1926-27 is as follows:—President, Dr. W. H. Eccles, F.R.S.; vice-president, Colonel T. F. Purves, O.B.E.; hon. treasurer, Lieut.-Col. F. A. Cortez Leigh, T.D., R.E.; ordinary members of Council, (Members) Mr. A. C. Cramb, Dr. A. H. Railing, Dr. S. Parker Smith, and Mr. A. J. Stubbs; (Associate Member) Mr. F. W. Crawter.

The Electricity (Supply) Bill.—According to *The Times Trade Supplement*, the secretary of the Association of British Chambers of Commerce has written to the Prime Minister, by direction of the president and the Executive Council of the Association, stating that certain aspects of the Bill are causing very grave concern to the members of the various chambers of commerce throughout the country. They urge that the standardisation of frequency in large and already efficiently-developed areas should be optional; the legitimate interests of owners of efficient electricity undertakings will be adversely affected financially and technically; industrial areas may have to bear the burden of uneconomical areas; and that the direct supply of electricity by the owners of efficient electrical undertakings should not be interfered with.

These four points are put forward as of vital importance, to which, it is suggested, amendments should be submitted by the Government on the Report stage in order to give effect to the earnest desires of the commercial community. The Association asks the Prime Minister to receive a deputation at as early a date as possible.

At a meeting of the Council of the Birmingham Chamber of Commerce last week, the General Purposes Committee reported that certain of the electricity supply authorities and other organisations had been taking steps to bring about amendments in the Electricity (Supply) Bill calculated to serve the interests of consumers in those areas where the system of supply was other than the standard system of 50 cycles per second. One such amendment provided for payment of reasonable compensation to consumers for disturbance during the period of change from one system to the other. The Government had intimated that it was not prepared to accept this amendment, and intended that when an Order was made for a change of frequency, no provision should be included for the payment of compensation. The Committee felt that in the case of manufacturers receiving a public supply of electrical power it would be imposing a great hardship if they were required to change their plant without compensation. It recommended that representation should be made to the Minister of Transport urging the Government to modify the present proposals. The Council approved the report.

The Times reports that the Government has decided to postpone until the autumn the report stage and third reading of the Bill.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. A. W. EDWARDS, Deputy Controller of the Central Telegraph Office, retired on Saturday last after 45 years' service.

Mr. F. H. DE LATTRE is retiring at the end of the month from the position of accountant to the Birmingham Electric Supply Department, which he has held for the past 34 years. Mr. J. B. DOW, who was appointed assistant secretary early last year, has been promoted to the position of accountant to the Department.

Mr. W. E. LANE, M.I.E.E., F.C.I.S., successfully underwent an operation for chronic appendicitis on July 12th, at the Peace Memorial Hospital, Watford, and is to return home tomorrow. His many friends will join us in congratulations, and the hope that he may enjoy the best of health in future.

Mr. A. CARTWRIGHT has been appointed a director of Vickers, Ltd., and Mr. G. G. SIM has been appointed secretary of that company.

Dr. THOMAS S. MCLOUGHLIN, the Irish representative of Messrs. Siemens-Schuckert, the Shannon power scheme contractors, was married at Limerick on July 14th to Miss OLIVE O'MALLEY.

Among the recent appointments as Officers of the French Legion of Honour are M. H. J. BACHELLERY, chief engineer of the Midi Railway Co.; M. P. J. A. BRENOT, vice-president of the French Syndicat Professionel des Industries Radio-Electriques; and M. E. VEDOVELLI, well known for his work in connection with illuminated fountains.

Miss MARY RENWICK, daughter of Sir Harry Renwick, K.B.E., is to be married to Mr. J. E. GUTHE, of Kepwitk Hall, Northallerton, Yorkshire, on July 27th, at 2-15 p.m., at St. Margaret's, Westminster. A reception at Claridge's Hotel will follow.

Professor J. A. FLEMING is retiring from the chair of Electrical Engineering at University College, which he has held since its foundation in 1884. His friends, his colleagues and his students desire to give expression to their personal affection and regard for him, as well as to their admiration for the distinguished services that he has rendered to electrical science, and having ascertained that it will be pleasing to him if his portrait be painted, a committee, of which Mr. A. A. Campbell Swinton is chairman, is inviting subscriptions for the purpose of a portrait, to be placed in University College, and of a replica to be given to Professor Fleming himself, who wishes to offer it to the Institution of Electrical Engineers. It is desired that the Portrait Fund should be provided by a large number of relatively small subscriptions. Any gift, however small, will be acceptable, and no individual subscription should exceed five guineas. Should the subscriptions exceed the amount required, the balance may be handed to the Fleming Endowment Fund that is being raised for the Department of Electrical Engineering, in connection with the celebration of the centenary of the College. Subscriptions should be sent to Professor W. C. Clinton, University College, London, W.C.1. Cheques should be drawn in favour of the Fleming Portrait Fund, and crossed Midland Bank, Ltd., Tottenham Court Road.

On Thursday last week, at the Savoy Hotel, a luncheon attended by gentlemen representing various branches of wireless activity, was given by invitation of the *Wireless Dealer* in honour of Prof. L. A. HAZELTINE, F.A.I.E.E., Member A.S.Mech.E., Fellow I.R.E. Mr. Percy W. Harris presided in the unavoidable absence of Mr. Scott Taggart, and offered a few words of welcome to Prof. Hazeltine, who is on a radio investigation visit to this country, and said that one of the greatest problems here was the howler which their guest had by his inventions done so much to eliminate in America. Prof. Hazeltine, in replying, reviewed the important advance steps that had taken place in radio development, mentioning the achievements of workers on both sides of the Atlantic, among them the neutrodyne, in connection with which he in America and Scott Taggart here had been working along the same line. We refer to some of the other speeches at the function in our "Radio Notes."

Major E. A. PELLS, A.M.I.E.E., has joined the board of Messrs. Richard Hunt & Co., Ltd., 39, Victoria Street, S.W.1, taking control of their electrical activities.

Obituary.—MR. W. H. STEELE.—The death has taken place, at the age of 49 years, after an operation, of Mr. William Henry Steele, who had for about 28 years been engaged in the electrical department of the Whitehaven Corporation.

MR. WALTER DIXON.—We regret to announce the death of Mr. Walter Dixon, senior partner of Messrs. Walter Dixon and Co., consulting engineers, Glasgow, which took place at his Glasgow residence on July 12th.

Wills.—The late Mr. EDWARD ALFRED GRAHAM (Alfred Graham & Co.), left £140,536 gross and £105,911 net personalty.

Mr. A. T. SMITH, a director of Electro-Bleach and By-Products, Ltd., and other companies, left £23,937.

New Companies Registered.

Bridges-Bower, Ltd. (214,977).—Private company. Registered July 12th. Capital, £500 in £1 shares. Objects:—To carry on the business of radio and electrical engineers and makers, importers and exporters of, and wholesale and retail dealers in all kinds of electrical apparatus, machines, instruments, accessories and goods, &c. The permanent directors are:—C. B. Webb, 14, Kensington Mansions, S.W.; Mrs. Dorothy King, Portman Hotel, Marble Arch, W.1. Solicitors: Abbott & Hudson, 2-3, Philpot Lane, E.C.3. Registered office: 34, Crutched Friars, E.C.3.

Maisonette, Ltd. (215,089).—Private company. Registered July 16th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, mechanical engineers, and manufacturers, workers and dealers in electricity, motive power, and light, &c. The directors are:—H. Eccles, 7, Burford Drive, Whalley Range, Manchester; H. Burrows, 5, Veronica Road, Didsbury, Manchester. Qualification, £1. Solicitor: A. Davies, 89, Fountain Street, Manchester. Registered office: Viaduct Works, Viaduct Street, Ardwick, Manchester.

C. Mortlock, Ltd. (215,025).—Private company. Registered July 14th. Capital, £1,000 in £1 shares. To acquire the business of an electrical engineer and contractor, carried on in Penge, S.E., as C.

Mortlock, and to adopt an agreement with C. T. Mortlock. The subscribers (each with one share) are:—C. T. Mortlock, 30, Station Road, Penge, S.E.20, electrical engineer; Mrs. E. A. Mortlock, 30, Station Road, Penge, S.E.20. C. T. Mortlock signs as director. Qualification, £50. Remuneration as fixed by the company. Solicitors: Frank Lewis & Sons, Arcade Chambers, Newport.

Franklin & Freeman, Ltd. (214,960).—Private company. Registered July 10th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of manufacturers of appliances for all wireless installations, electrical engineers, manufacturers of and dealers in electrical wire, &c. The subscribers (each with one share) are:—J. Gilbert, 7, Rosebery Gardens, W.13, accordian pleater; E. D. Scott, 46, Elers Road, West Ealing, factory manager. J. Gilbert signs as director. Solicitors: Raymond, Oliver and Co., 25, Bedford Row, W.C.1. Registered office: 13, Appold Street, Bishopsgate, E.C.2.

Wavio, Ltd. (215,023).—Private company. Registered July 13th. Capital, £500 in £1 shares. Objects: To manufacture, assemble, erect and maintain, repair and deal in wireless, telegraphic and telephonic apparatus, valves, instruments, equipment, accessories, electrical, magnetic and radioactive instruments and apparatus, and vehicles and buildings for demonstrating and exhibiting the same, &c. The directors are:—G. D. Lush, 33, The Ridgeway, Friern Barnet, managing director of private company (permanent); P. Gibb, 153, Hewitt Avenue, Wood Green, N.22, director of private company; C. G. Dowsing, address not stated; C. H. Hitching, address not stated. Solicitors: Mawby & Barrie, 101, Salisbury House, London Wall, E.C.2. Registered office: 40b, Queen Street, Hitchin.

Sterland & Tate, Ltd. (215,022).—Private company. Registered July 13th. Capital, £1,500 in £1 shares. Objects:—To acquire the business carried on at 41, Blandford Street, Sunderland, as Sterland and Tate, and to carry on the business of mechanical transport, ignition repairers, manufacturers and factors of electrical and other goods, more especially magnetos, magneto parts, lighting set parts, and the like, &c. The directors are:—L. Sterland, 42, Harrogate Street, Sunderland, auto-electrical engineer; J. H. Tate, Lambton House, Houghton-le-Spring, auto-electrical engineer; F. P. Townsend, 6, Chester Street, Coventry, instrument manufacturer; all permanent. Qualification, 50 shares. Remuneration of permanent directors as fixed by agreement; of other directors as fixed by the company.

Institution of Heating and Ventilating Engineers (214,973).—Registered on July 10th, as a company limited by guarantee, and not having a share capital, with 2,500 members, each liable for £1 in the event of winding up, the word "limited" being omitted from title by licence of the Board of Trade. The income and property of the association, whencesoever derived, is to be applied solely towards the promotion of its objects. The objects are to promote the science and practice of heating and ventilating, domestic hot water supplies, and all branches of engineering kindred thereto, &c. The first directors are:—W. N. Haden, St. George's Works, Trowbridge, engineer; C. I. Haden, St. George's Works, Trowbridge, engineer; E. Herring, 22, Keswick Road, Putney, S.W., engineer; A. H. Barker, Oakhill House, The Knoll, Beckenham, engineer; A. A. Jones, 25, Wordsworth Walk, Hampstead Garden Suburb, N.W., engineer; O. Stott, Huncote House, Huncote, Lincolnshire, engineer; W. W. Nobbs, 50, Fairhazel Gardens, N.W.6. Secretary: W. G. Hollinworth, 126, Wrottesley Road, Harlesden, N.W.10. Registered office: 38, Victoria Street, S.W.1.

Official Returns of Electrical Companies.

Electrolux, Ltd.—Satisfaction in full on July 2nd, 1926, of debenture dated October 7th, 1924, securing all moneys due or to become due from the company to the bank. Debenture charged on certain land and buildings at Leagrave, Bedfordshire, known as Omnia Works, and the company's undertaking and property, present and future, including uncalled capital, dated July 2nd, 1926, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Napier-Kimber, Ltd.—Florence Tompkins, of 70, Great Portland Street, W.1, was appointed receiver on July 2nd, 1926, under powers contained in a first mortgage debenture dated June 5th, 1923.

English Electric Co., Ltd.—Satisfaction to the extent of £32,800 on April 22nd 1926, of 1st mortgage debentures secured by trust deed dated September 15th, 1919, securing £1,000,000.

McLeod & Sons, Ltd.—G. Miller, incorporated accountant, of 19, Castle Street, Liverpool, was appointed receiver and manager on March 22nd, 1926, under powers contained in debenture dated December 29th, 1924.

W. H. Allen, Sons & Co., Ltd.—Charge on the company's property, present and future, including uncalled capital, dated June 21st, 1926, to secure unascertained amount of excess profits duty, interest, income tax, and corporation profits tax. Holders: Commissioners of Inland Revenue.

W. A. Saxby & Co., Ltd.—W. A. Saxby, of "The Greenway," Whitton Road, Hounslow, ceased to act as receiver or manager on May 11th, 1926.

Kirby (Wimbledon), Ltd.—W. T. Flower, of 12, Hill Road, Wimbledon, was appointed receiver and manager on July 8th, 1926, under powers contained in debenture dated November 23rd, 1925. W. T. Greenland of 8, Dunmore Road, Wimbledon, ceased to act as receiver or manager on the above first-mentioned date.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Burndept Wireless, Ltd.

The first ordinary general meeting was held on July 16th, Sir George C. Hamilton, J.P. (chairman) presiding. In moving the adoption of the report, the Chairman, having referred to the resignations of Lord Lurgan and Mr. G. E. Duveen, the former chairman and vice-chairman of the company, respectively, said it was a matter of great regret to the board that the first report of the company should make such a poor showing, and that it was impossible for any dividend to be declared. In April, 1925, the prospects appeared most promising, and it was impossible then for the board to foresee that during the winter of 1925-26 there would be a world-wide slump in the domestic wireless trade. It was generally believed throughout the British trade, and the American, that 1925-26 would be a record wireless year. They accordingly purchased further machinery, proceeded to enlarge their factories, opened new branches, improved their motor transport, increased their staff, both administrative and executive, extended their advertising programme, and embarked on a strong campaign to make their name and goods well known. They increased their stocks of raw materials, and acquired the business of one or two of their principal agents; in fact, they did everything to ensure greater production and a more efficient selling organisation. Their principal subsidiary company—Radio Accessories, Ltd., was housed in a very fine factory which was purchased freehold. £45,000 out of the £60,000 allowed for in the prospectus was paid up and an extensive and modern plant for the manufacture of valves and cabinets was laid down, and the board had every reason to believe that the company would derive very considerable profit from its investment in Radio, Ltd., the sale of whose products was handled by the parent company. Unfortunately, that did not prove to be the case. In spite of all their efforts the company's turnover for the nine months ended December 31st, 1925, was only £210,297, as against their predecessors' turnover of £266,636 for the corresponding nine months of 1924. At the end of last year negotiations were opened between the company and Marconi's Wireless Telegraph Co., Ltd., with a view to ascertaining the possibility of consolidating their mutual interests. It was anticipated that such a combination would result in a substantial decrease in expenses and would prove a very profitable development for the shareholders, and that they would be able to obtain a considerable portion of the world's domestic radio business at a minimum of cost. The final scheme, which was to form the basis of the agreement between the companies, provided for an increase in the capital of the company, its change of name, the amalgamation of the company with the Marconiphone and Sterling Companies, and the financing of the combine on terms favourable to all concerned. Unfortunately, before the final arrangements had been concluded the general strike intervened, and owing to monetary stringency it became impossible at that time to arrange the necessary finance, and the negotiations therefore became abortive. Having referred in detail to the accounts, the chairman said, with regard to their prospects for the current and future years, that it was obvious that to achieve success they must cut their expenditure to a minimum, produce new apparatus, and endeavour to increase the turnover. A net saving of £2,019 had been made in the expenditure on salaries and wages in the three months April, May, and June of the current year, which was at the rate of £8,077 per annum. There had also been a reduction of £17,000 in the last quarter in the purchases of raw material. It was proposed to cut down the advertising expenditure by approximately 50 per cent., and the head office had been transferred to Blackheath, while all except five of the provincial offices had been closed down. The effect of those economies had not yet been reflected in the accounts, nor the further economies which should result from the unification of control and the close co-operation of staff consequent upon the consolidation of the administration and factory at Blackheath. If their estimates proved correct, a further saving of about £15,000 per annum should be experienced in general administrative expenditure. As regarded the present position sales for the 13 weeks to June 30th, 1926, had gone up rather more than 15 per cent., compared with the corresponding period of last year, and they had no obsolete stock. Since January 1st last 1,982 new accounts had been opened. The Wireless Exhibition at Olympia opened on September 4th, and before the end of August they would have produced and have in the hands of their travellers four entirely new and improved receiving sets of the best quality and various new and ingenious components. They had also secured the sole licences in this country for two of America's best sellers, the "Balkite trickle charger" and the "Raytheon tube." Both articles were well in production in their factories, and whilst they were prepared to grant licences to manufacture to one or two responsible houses, they were determined to uphold their rights under the patents against importers and infringers. They had developed a sales campaign for this season, which, although highly intensive, would not be as costly as last season. The subsidiary Radio Accessories, Ltd., was now producing valves. Improvements had been made in manufacture which would ensure long life and great efficiency to their products. The executive had every reason to expect, provided we had industrial peace at home and nothing was done at that meeting to create a feeling of uncertainty and distrust, which would reflect seriously on the goodwill and prestige of the business, that they would pull through and put the company in such a state that it would be able to pay its shareholders at the end of the season at least the dividend which they were missing at the moment. Mr. W. W. Burnham seconded the motion. After considerable discussion the report was adopted, and a resolution was carried by which the board undertook to co-opt as soon as possible two directors from nominations made by three shareholders, Messrs. Hamlyn, Heybourn, and Hart, who agreed to confer with the board on the matter.

Greenwood and Batley, Ltd.

The annual meeting was held on July 14th. Col. O. C. Armstrong, D.S.O., who presided, said that the position of the company was not entirely satisfactory, and the prospects of substantial betterment were uncertain. Certain of the causes of that were beyond their control, but he thought that freedom from labour troubles would counteract much of the depression due to those causes. He considered

that the method of voting at trade union meetings when momentous decisions were taken should be rigidly restricted to ensure that delegates really represented a substantial majority of those for whom they spoke. The unstable labour conditions had seriously affected their output and profits, and their order book at present was feeling the effect of the general stagnation. The company was in a strong position, however; the reserves and surplus of profit and loss account totalled over £200,000, or 57 per cent. of the paid-up ordinary capital. The liquid assets continued to make the balance sheet a favourable one, and, upon the whole, the shareholders could justly congratulate themselves upon the satisfactory position of the company.

Scarborough Electric Supply Co., Ltd.

The report for the year ended December 31st, 1925, states that the whole of the company's undertaking was handed over to the Scarborough Corporation on January 1st last, the price, fixed by arbitration, being £173,484, in addition to certain small sums for interest and expenses. The accounts for 1925 show a profit of £22,35 , and to this is added £13,018 brought forward and £196 bank interest, making £35,565. After meeting debenture interest, &c., there remains £31,823. An interim dividend of 6 per cent., free of tax, was paid, and it is now proposed to pay a further 5 per cent., less tax, leaving a balance of £23,823. The directors calculate that with this balance there will be sufficient to make a return of not less than 25s. per £1 share, after redeeming the outstanding debentures and meeting all expenses. Notice has been given of a resolution proposing the setting aside of £3,750 as compensation to the directors and other officials for loss of office. At the meeting which is to be held to-morrow (Saturday) resolutions will be put forward for the liquidation of the company, &c. A confirmatory meeting will be held on August 14th.

Petters, Ltd.

Sir Ernest W. Petter presided at the annual meeting on July 14th, and in the course of his speech said that the trading for the past year showed continued improvement. It was particularly gratifying that the sales of their oil engines in overseas markets had increased. The aircraft department was developing and they had secured the services of Capt. Hill and the patents relating to his invention of the tailless aeroplane. They were able to pay a dividend of 5 per cent. on the ordinary shares—the first for five years. Their subsidiary company, Vickers-Petters, Ltd., commenced the year with hopes of an improvement, but its business would be severely affected by the coal dispute. With regard to home affairs, Sir Ernest said that the present and preceding Governments were to be blamed for pursuing a financial instead of an industrial policy. Industry should be placed in the forefront of our affairs. In conclusion, he said that we must look to our Empire for our future prosperity.

German Companies.

The directors of the *Dr. Paul Meyer Company, Berlin*, makers of electrical apparatus, report a loss of 2,208,000 marks for 1925, which has been extinguished by writing down the capital in the proportion of five to one, the capital then being again increased to 3,500,000 marks. It was stated at the recent meeting, that since the end of last year the situation has been further consolidated, orders are on hand for several months and satisfactory results are expected for the current year.

The *Berlin Elevated and Underground Railway Company* reports a decline in the number of passengers carried in 1925, although the receipts increased. In the current year, however, a diminution in the receipts has taken place consequent upon the fares being raised, which action has not been followed by the municipal tramways. It is stated that the continuation of such a policy by the City would cause the dividends of the railways to decline in future years. In the circumstances an agreement has been entered into with the City authorities for the absorption of the North-South Railway and the Schoneberg section, the capital transactions involved giving the City authorities control over the combined undertaking.

French Companies.

The *Compagnie Lorraine de Charbons, Lampes et Appareillages Electriques*, records net profits of 500,000 fr. for 1925, and a dividend of 12 fr. per share.

The *Compagnie Française des Câbles Télégraphiques*, which has decided to pay a dividend at the rate of 30.05 fr. per ordinary share for 1925, reports that the company is still awaiting the sanction of the Government to dispose of its network in the West Indies. In the meantime the necessary measures are being taken to renew the expired local contracts, while at the same time preserving the company's freedom in case the working might no longer be profitable. It is proposed to devote the proceeds of the sale to the improvement of the transatlantic cables in order to meet foreign competition and the rivalry of radio-telegraphy.

Victoria Falls and Transvaal Power Co., Ltd.—The report of the directors for the year ended December 31st, 1925, states that the capital at that date was £3,000,000, and the amount of debentures outstanding £2,462,080. After providing for debenture interest, depreciation, taxes, &c., there was a net profit for the year of £363,940. To this is added £117,657 brought forward, making £481,597. Out of this £50,000 has been transferred to reserve, and after providing for total dividends of 10 per cent. on the preference shares and 14 per cent. on the ordinary shares, there remains a balance of £126,662 to be carried forward. The annual meeting is to be held on July 29th.

Agricultural and General Engineers, Ltd.—The report for the year ended March 31st states that in spite of industrial depression the results of the Associated Companies showed encouraging improvement. Dividends amounting to £93,697 were received and to this is added £11,154 surplus on Aldwych House revenue account. After charging administrative expenses, &c., there remains a balance of £52,471, which it is proposed to carry forward to the revenue account, making the balance £63,332. Meeting, July 29th.

Companies Struck off the Register.—The following companies have been struck off the Register, and they are thereby dissolved :—

Aeradio, Ltd.
Broadcast Wireless Co., Ltd
Car Electrical Service, Ltd.
Electois, Ltd.
Electricians, Ltd.
Expert Electrical Co., Ltd.
Magniphone Co., Ltd.
Manchester Wireless Installation Co., Ltd.
Wilton Wireless Co., Ltd.
Wireless Telephones, Ltd.
Auto-Electrical Services, Ltd.
Newcastle and Sunderland Oxy-Electric Welding and Metallurgical Co., Ltd.
Perak Hydro-Electric Power Syndicate, Ltd.
Triumph Electric Manufacturing Co., Ltd.
World's Electric Co., Ltd.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted :—

Callender's Cable and Construction Co., Ltd.—200,000 ordinary shares of £1 each, fully paid, Nos. 600,001 to 800,000.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Venezuela Telephone and Electrical Appliances.—70,000 ordinary shares of £1 each, fully paid, Nos. 1 to 70,000; 35,000 new ordinary shares of £1 each, fully paid, Nos. 140,001 to 175,000; 35,000 new eight per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 210,001 to 245,000.

Reductions of Capital.—MAWDSLEY'S, LTD. AND REDUCED.—A petition for the confirmation of the reduction of this company's capital from £20,000 to £13,333 is to be heard by Mr. Justice Romer at the Law Courts on July 27th.

DICTOGRAPH TELEPHONES, LTD. AND REDUCED.—In the Chancery Division on July 1st, Mr. Justice Romer made an order confirming the reduction of the company's capital from £80,000 to £61,500.

South-Eastern Power and Light Co.—The report for 1925 shows gross earnings by the company and its subsidiaries of $17,796,847, an increase of nearly eight million dollars. The net income rose from $4,665,471 to $8,627,714. The capital issues by subsidiary companies during the year totalled $43,112,803.

Anglo-American Telegraph Co., Ltd.—Dividends of £1 10s. per cent. on the preferred stock and 15s. per cent. on the ordinary stock have been declared in respect of the quarter ended June 30th, as in 1925.

Herbert Morris, Ltd.—The half-yearly dividends have been declared on the 6 per cent. and 5 per cent. (free of tax) cumulative preference shares.

Electrolytic Zinc Co. of Australasia, Ltd.—A half-yearly dividend of 6 per cent. has been declared on both the preference and ordinary shares, as in 1925.

County of London Electric Supply Co., Ltd.—An interim dividend of 5 per cent. has been declared on the ordinary shares, as in 1925.

South Metropolitan Electric Light and Power Co., Ltd.—Interim dividend of 5 per cent. on the ordinary shares, as in 1925.

South London Electric Supply Corporation, Ltd.—Interim dividend of 5 per cent. on the ordinary shares, as last year.

Dublin United Tramways Co., Ltd.—An interim dividend at the rate of 4 per cent. per annum has been declared.

Montreal Light, Heat and Power Co.—A dividend of $2 per share has been declared on the common shares.

Stocks and Shares.

MONDAY EVENING.

THE money market gives little indication of developing that pronounced ease which it was expected to exhibit as soon as the half-year had definitely turned. In consequence, Stock Exchange markets are resigning themselves to the probability of the 5 per cent. Bank Rate remaining in force, possibly until the end of the year. This consideration is a disappointment, but so great is the volume of capital awaiting investment, owing, of course, to the impossibility of its being employed profitably in trade, that investment stocks and shares are taken with readiness, in spite of the increasing competition which they meet in the shape of new issues.

The manufacturing shares in our lists are inclined to droop, but the purely investment securities are noticeably good. It

may be said without fear of contradiction that all the debenture stocks of the front rank electricity supply companies are in such demand as to render them almost unobtainable. This week a further substantial rise in the stocks and shares of the Eastern cable companies is again a feature. The latter is due to the concession granted by the Greek Government to the Eastern Telegraph Company, enabling the latter to deal with wireless as well as cable communication. As a corollary to this, Marconi shares are inclined to be dull. The outsider, looking at the business from the detached point of view, will be moved to inquire whether a combination between wireless and cable is not the ideal method of working, and to look for the day when the two classes of companies can merge their interests into a joint system of operation.

The coal crisis is responsible for heaviness amongst Home Railway stocks, and falls have taken place in Metropolitans, Districts, and the Underground Electric Railways of London issues. As the day approaches for the meeting of the last-named company, interest becomes quickened in the elaboration of the scheme which the chairman will place before his fellow-proprietors, for although the published particulars went very explicitly into details, there remain important points upon which official information will be welcome.

The Metropolitan dividend is due to be declared on the Thursday in this week. Stock Exchange prophets amuse themselves as a rule at this time of the year with endeavouring to forecast what the dividends on Home Railway stocks are likely to be, but, with the coal outlook so uncertain as it is, even this occupation has ceased to charm. Men in the market are frankly afraid of guessing whether the Metropolitan announcement, now due, will equal the 1½ per cent. actual declared a year ago, or whether the rate will be reduced.

To the strength of cable stocks reference has been made above. Eastern Telegraph ordinary has risen 6 to 191. Globes reacted to 19, and recovered to 19½, to which price Eastern Extensions have also improved. Westerns, although 5s. up at 18½, have lagged behind the rest of the group, as indeed they generally do. Possibly the investor is less inclined to buy these than the others, owing to the fact that competition is keener in the Western sphere of influence than it is in that of the others. Marconis are a heavy market, owing to the same reason which has served to advance the prices of Eastern cable stocks, and no interest is taken in Radio Corporations. Marconi Marines have fallen back to 20s. Burndept Wireless are harder at 9s. as a result of the proceedings at last week's meeting.

Edmundson's ordinary are a few pence better on the week at 24s. 3d., and the only other change in this list is a gain of 1/16, to 1¼, in Urban Electric Supply ordinary shares. Save for these two, no quotable alterations have occurred, the market being idle and prices stagnant, as, indeed, is usually the case at this season of the year. Manufacturing shares have gone back a little further. Edisons make an exception, the ordinary shares being 6d. up at 10s. 6d. and the company's 5 per cent. debenture gaining 4 points at 86. Edison 5½ per cent. second debenture, it may be added, stands at 83 middle, last changing hands at 81 a year ago. Interest payments are due in March and September. Ericsson's Telephone 7 per cent. preferences at 22s. are 2s. premium, but Telephone Manufacturing shares at 1s. 6d., with 2s. 6d. paid, have recovered very little from the discount to which they fell upon the comparative failure of the company's appeal to the public last month, when 10s. shares were offered for subscription at 7s. 6d. apiece. The next call of 1s. 9d. is due on September 15th, the remaining 3s. 3d. not being payable until December 10th.

English Electrics have receded again, being now 14s. 6d. General Electrics are easier at 30s. Johnson & Phillips fell a florin to three guineas, Siemens a shilling to 27s. British Aluminium dropped to 47s., and British Insulated at 3¾ are again 1/16 down, the market generally speaking being dull and disposed to sensitive fluctuation upon any little pressure exerted from sellers. The financial crisis in Paris is exercising an influence far beyond its immediate and local bounds.

British Columbia Electric Railway stocks are strong, the preferred being 4 points higher and the deferred 2. Otherwise, the tendency here is towards lower values. Falls are marked in Anglo-Argentine firsts, Brazilian Tractions, and British Electric Tractions. Victoria Falls ordinary rose to 55s. upon publication of an excellent report. The year's net profit of £363,900 is £14,000 better than that of the previous twelvemonth. The ordinary shares receive 14 per cent. dividend against 12½ per cent., and the carry-forward is handsomely increased. The company has spent £782,000 on its Witbank property, and proposes to erect two more sets of 20,000 kilowatts each.

The chairman of the General Electric Company, at last week's meeting of proprietors, looked forward to the time when, say, five years hence, electric current shall be "ubiquitous throughout the country." This vision he linked to the progress of the Electricity Bill, and he claimed that the British manufacturer will be able, under conditions developed from the Bill, to enter again more freely the markets of the world. For the immediate present, the Stock Exchange is slightly overcast by the daily increasing losses imposed by the coal stoppage, as well as by the more indirect effects produced through the demoralisation of French national finance. These last are felt in the rubber share market, amongst other sections, and the engineering group is, of course, closely touched by the effect of the failure to settle the coal industry's trouble.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price July 19 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	56/3	—	4 19 8
Brompton Ordinary	1	10	10	31/9	—	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref ...	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	48/3	—	6 4 4
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	59/6	—	5 0 10
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	24/3	+3d.	6 19 0
do. 7% Pref.	1	6	7	22/6	—	6 4 5
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	18⅝	—	5 9 1
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	32/6	—	6 8 1
do. do. 6% Pref.	5	6	6	5⅞	—	5 10 8
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	21/-	—	5 18 1
Newcastle-on-Tyne Ordinary ...	1	7	7	22/-	—	6 7 3
do. 5% Pref. ...	1	5	5	18/-	—	5 11 1
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.... ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	18⅜	—	5 6 10
South London...	1	15	15	2⅜	—	5 14 3
South Metropolitan Pref.	1	7	7	26/3	—	5 6 8
Urban Ordinary	1	4	7	1⅜	+1/16	6 4 5
do. 6% Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	43/3	—	6 18 6
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	20/3	—	7 8 0
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	63½	—1	7 17 9
do. District	,,	8½	8½	52½	—1	8 13 6
Underground Electric Ordinary ...	10	Nil	Nil	3⅜	—⅛	Nil
do. do. "A" ...	1/-	Nil	Nil	11/-	—6d.	Nil
do. do. Income ...	Bonds	5	5	102	—	*5 17 10

TELEGRAPHS AND TELEPHONES.

		Dividend. 1924	Dividend. 1925.			
Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 3
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	3	6	2½	—	4 0 0
Chili Telephone	5	5	6	7	—	*4 5 9
Cuba Sub. Ord.	10	5	5	6¼	+¼	7 5 6
Eastern Extension	10	10	10	19½	+⅜	*5 4 8
Eastern Tel. Ord.	Stock	10	10	191	+6	*5 5 0
Globe Tel. and T. Ord.	10	10	10	19½	+½	*5 4 8
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel....	10	22	20	27	—	7 7 1
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi...	1	10	10	1⅜	—	8 17 10
Marconi Marine	1	10	7½	1	—1/16	7 10 0
Oriental Telephone Ord.	1	12	12	45/-	—	*5 6 8
United R. Plate Tel....	5	8	8	8⅛	—	*4 18 6
Western Telegraph	10	10	10	18½	+½	*5 8 1

HOME AND FOREIGN TRAMS, &C.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8½	—1/16	8 9 2
do. do. 2nd Pref. ...	5	6	6	2⅝	—	10 8 8
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 1
British Electric Traction Ord. ...	,,	7	8	137½	—2½	5 16 5
do. do. 6% Pref. ...	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	104	—1	4 16 2
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	85½	—1	5 17 0
do. do. Preferred ...	,,	96/-	126/9	107½	+2	*5 17 11
do. do. Deferred ...	,,	129/8	8	134	+4	*5 9 5
do. do. Deb. ...	,,	4½	4½	79	+1	5 7 7
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	47	—	8 10 2
Mexico Trams 5% Bonds	—	5	5	71½	—1	6 19 10
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	85½	+2	Nil
do. 1st Bonds	—	5	5	72½	—	6 17 11
Yorkshire (West Riding)	1	5	—	11/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	51/-	—	*5 2 0
British Aluminium Ord.	1	5	10	47/-	—1/9	4 5 1
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3¾	—⅛	4 8 11
Brush Ord.	1	10	10	1½	—	5 0 0
Callenders	1	15	15	3½	—	4 12 4
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/8	—	... ...
Edison-Swan	4/-	10	10	10/6	+6d.	3 16 2
do. 5% Deb.	Stock	5	5	86	+4	5 16 3
Electric Construction	1	10	10	32/-	—	6 0 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	5	Nil	14/6	—6d.	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 18 1
,, Ord.	1	5	7½	30/-	—6d.	5 0 0
Henley	1	16	20	8⅝	—	5 8 8
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber...	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	63/-	—2/-	5 11 1
Met.-Vickers Ord.	1	8	8	24/6	—6d.	6 12 0
do. Pref.	2	8	8	2½	—	6 8 6
Siemens Ord.	1	7½	7½	27/-	—1/-	5 11 1
Telegraph Construction	12	20	10	28½	—	*4 4 0

*Dividends paid free of Income Tax.

Exports and Imports of Electrical Goods and Machinery in June, 1926.

As was to be expected, our foreign electrical trade during June still bore heavy traces of the effects of the general strike, emphasised, no doubt, by the continuance of the coal dispute. There was certainly a recovery from the May export total, but it was to all intents and purposes negligible, as comparison with the statistics for the corresponding month of last year demonstrates; the decline from the June, 1925, total was over £111,000. It is curious, however, that the individual items of our exports showed some very wide fluctuations above and below the May level. For instance, telegraph and telephone instruments and apparatus, unenumerated electrical goods, and insulated wires and cables, all showed fairly substantial increases, while on the other hand, large falls were experienced by the three principal classes of electrical machinery and non-submarine telegraph and telephone wires and cable. It is to be observed that in comparison with the June, 1925, figures the same two items—telegraph and telephone instruments and apparatus and other motors and generators—exhibited the largest rise and fall respectively, showing that last month's exports of these classes of goods were not normal. Submarine cables do not seriously affect the total this time. Pursuing the comparison with the June, 1925, statistics, it is seen that exports of batteries and accumulators were halved in value, while in the import section a considerable increase is shown, indicating a change-over of some proportion. The same observations apply to some extent to unenumerated electrical machinery, while the reverse process occurred in the case of telegraph and telephone instruments and apparatus.

With two exceptions, the increase in the import total was general, the two exceptions, arc lamps and carbons, showing small increases which failed to affect the total very much. Most of the increases were of substantial amounts, and the rise in unenumerated electrical machinery was the outstanding example. The rise above the total for the corresponding month of last year was a great deal smaller—in fact, the decreases predominated in number but were outweighed by increases in five items, the greatest of which was again in the item unenumerated electrical machinery.

The re-export section, generally speaking, was a pale reflection of the export division, the total being higher than that of the preceding month, but lower than the June, 1925, figure.

The half-yearly figures at the foot of our table show further decreases in the export and re-export sections, but the import section has regained about £38,000.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for June, 1926.	Inc. or dec. as compared with May, 1926.	Inc. or dec. as compared with June, 1925.	Electrical imports for June, 1926.	Inc. or dec. as compared with May, 1926.	Inc. or dec. as compared with June, 1925.	Electrical re-exports for June, 1926.	Inc. or dec. as compared with May, 1926.	Inc. or dec as compared with June, 1925.
Electrical goods and apparatus (unenumerated)	£150,110	+ £29,841	+ £7,325	£107,214	+ £27,022	+ £27,867	£3,321	— £946	— £752
Insulated wires and cables	212,845	- 13,607	— 24,521	46,928	+ 25,010	— 18,893	1,233	+ 478	— 1,736
Glow lamps	34,759	+ 4,356	+ 9,307	23,971	+ 12,429	— 25,421	416	+ 313	— 36
Arc lamps and parts	461	+ 394	+ 159	309	— 1,236	— 503	7	— 113	— 21
Batteries and accumulators	53,816	— 9,911	— 54,024	47,432	+ 22,919	+ 24,744	526	— 73	— 1,057
Meters and instruments	26,775	— 9,560	— 2,851	20,747	+ 6,599	+ 9,868	660	+ 424	+ 448
Carbons	781	— 694	— 1,160	3,563	— 3,686	— 2,964	15	— 6	— 169
Electrical Machinery—									
Electrical machinery (unenumerated)	230,357	— 12,833	— 34,531	126,731	+ 45,735	+ 46,458	4,710	+ 2,251	— 120
Railway and tramway motors	25,506	— 28,263	+ 7,639	—	—	—	—	—	—
Other motors and generators	97,316	— 30,908	— 59,880	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	10,253	+ 7,416	+ 3,276	143	+ 115	+ 82	20	+ 20	+ 20
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	37,492	— 13,977	— 18,454	4,674	+ 3,818	— 11,236	429	+ 414	— 38
Submarine telegraph and telephone cable	3,406	+ 3,160	— 12,516	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus	289,910	+ 62,923	+ 68,845	27,082	+ 3,915	— 12,215	3,600	+ 778	— 1,100
Totals	£1,173,787	+ £15,551	— £111,386	£408,794	+ £139,140	+ £37,787	£14,927	— £3,540	— £4,561

	Exports.	Imports.	Re-exports.
Decreases for six months of 1926	£1,221,096	£347,704	£40,181

Canadian Electrical Notes.

[From Our Canadian Correspondent.]

SINCE there has recently been some discussion in the columns of the ELECTRICAL REVIEW relating to the question of wiring regulations, it may be of interest to state that the Canadian Engineering Standards Association some time ago appointed a committee to prepare an electrical "code" which would be suitable for use throughout all Canada. At the present time the rules and regulations of the Hydro-Electric Power Commission of Ontario are in force throughout the province, and in the remainder of the Dominion the "National Electrical Code," which holds sway throughout the United States, is generally followed. The Canadian Committee is made up of men representing the Governments of most of the provinces, the electrical manufacturers, the fire underwriters, and other interested bodies. At a meeting held in May a draft of the first section of the proposed Canadian electrical code, which had been prepared by two engineers selected by the committee, was considered, and after discussion it was decided to publish the first part as soon as possible with a view to giving it a trial in such provinces as might think fit to use it. Unavoidably, this proposed code follows very closely the National Electrical Code of the United States, but whereas the latter takes care almost exclusively of the fire risk and the United States has another set of rules covering risk to life, known as the "National Electrical Safety Code," for the preparation of which the Bureau of Standards at Washington was largely, if not entirely, responsible, the Canadian electrical code attempts to combine these two features in one book, thus making it simpler for workmen and others.

In Canada, the United States' plan of dealing with this matter has seemed to many to be decidedly cumbersome, as there are two codes, each of which covers practically the whole field of electrical work, at least in matters affecting the general public, so that any man engaged in work coming under only one heading, *e.g.*, electrical transmission and distribution lines,

would have to possess a copy of each code and pick out from each those sections and rules with which he was specially concerned. Under the Canadian plan he would merely have one book containing the necessary information regarding his own line of work.

Some months ago reference was made in these notes to a proposed tidal power scheme on which the people of the State of Maine had voted favourably. As the tidal waters of which it is proposed to make use are partly Canadian, the question naturally affects the Dominion, and there has been formed the "Canadian Dexter B. Cooper Company," which is seeking incorporation from the Dominion Government by a private Bill, which has apparently been through the Lower House and has already passed its first reading in the Senate. The company desires to secure a charter to develop power from the tidal waters of Passamaquoddy Bay, with a view to selling power in both Canada and the United States.

Visitors to Canada or the United States who have been to Niagara Falls, cannot fail to have noticed the immense "V" notch which that great cataract has formed in the "Horseshoe Fall" on the Canadian side. The unfortunate part about this notch is that the bigger it grows the more water is diverted from the other parts of the Falls, thus increasing its rate of growth, and of late years this has reached a serious stage.

Suggestions have been made from time to time for several years past as to how this notch might be filled in (so as to restore the proper curve of the Horseshoe) with reinforced concrete, but at last there has been formed by Canada and the United States, an international board whose duty it will be to study the question of preserving the scenic beauty of the Falls, which is undoubtedly being adversely affected by the rapid erosion, amounting now to some seven feet per annum, at the notch referred to. This board, which will also consider the problem of the proper apportionment between the two countries concerned, of water diversion, for power purposes, in the future, has the following personnel:—Mr. J. T. Johnston, Director of the Water and Reclamation Service, and Dr. Charles Camsall, Deputy-Minister of Mines, representing Canada; and Major D. C. Jones, United States Corps of Engineers, and Mr. J. Horace McFarland, representing the United States.

A new application of electricity in the home is manifesting itself in Canada, due to the ever-increasing price of coal. A number of householders last winter installed small electrically-driven fans, which were used as forced-draught fans on their furnaces, and with the insertion of new grate-bars in the furnaces they were able to burn the cheaper grades of coal. So far as the writer of these notes has been able to ascertain, the equipment cost, installed, about $50.00, and saved as much as, and in some cases more than, that amount during one season. The use of forced draught does not, however, seem desirable for this purpose, as domestic furnaces are by no means gas-tight and the possibility of someone's cellar becoming filled with carbon-monoxide gas with probably serious, if not fatal, consequences, is one that should not be taken too lightly. An induced-draught system would be infinitely better. It should be stated that most of these mechanical draught systems so far installed are operated automatically by means of a thermostat installed in the dining room or other convenient part of the house, and a very even temperature is the result. Since temperatures in Canada can easily fluctuate within 24 hours, or even less, through a range of 40 or 50 degrees in the winter time, automatic regulation of house-heating, though not usual, is very desirable.

Swiss Electrical Trade Statistics.

THE following statistics, showing the import and export trade of Switzerland in electrical and allied goods in 1925 have been taken from the recently-issued official trade returns. The figures for 1924 have also been given, and notes added of any increases or decreases. The returns show the most important but not all the countries of origin or destination of the goods. An asterisk has been placed where the absence of a figure means not necessarily that there has been no trade but that it has been of comparatively slight importance in the year indicated; in such cases the precise increase or decrease cannot be given.

Imports.

	1924. Fr.	1925. Fr.	Inc. or dec. Fr.
Electrical cable, not insulated—			
Total	77,000	75,000	– 2,000
From Germany	50 000	50 000	—
„ France	24,000	15 000	– 9,000
Insulated cable not lead covered or iron armoured—			
Total	217,000	500,000	+ 283,000
From Germany	95,000	290,000	+ 195,000
„ France	17,000	29,000	+ 12 000
„ Italy	20,000	5,000	– 15,000
„ Belgium	68,000	139,000	+ 71,000
„ Holland	—	4,000	+ 4,000
„ Great Britain ...	—	29,000	+ 29,000
Cable covered with lead—			
Total	117,000	289,000	+ 172,000
From Germany	8,000	287,000	+ 279,000
„ Italy	107.000	—	– 107,000
Cable covered with lead and iron armoured—			
Total	21,000	198,000	+ 177.000
From Germany	17,000	55,000	+ 38,000
„ Italy	4,000	52.000	+ 48.000
„ France	—	90,000	+ 90.000
Cable insulated with rubber or paper and covered with textiles—			
Total	619,000	866,000	+ 247,000
From Germany	110,000	355,000	+ 245,000
„ Italy	49,000	36,000	– 13,000
„ France	26,000	12,000	– 14,000
„ Belgium	168.000	304,000	+ 136.000
„ Holland	190,000	136,000	– 54,000
Cable ditto covered with lead—			
Total	1,194,000	383,000	– 811,000
From Germany	1,103,000	215.000	– 888,000
„ Belgium	36,000	44,000	+ 8,000
„ Italy	2,000	13,000	+ 11,000
„ Great Britain ...	34,000	85,000	+ 51,000
Dynamo-electric machines and electric transformers—			
Total	2,820,000	1,787,000	–1,033,000
From Germany	1,038,000	1,064.000	– 24 000
„ France	198 000	241,000	+ 43,000
„ Italy	32,000	62,000	+ 30 000
„ United Kingdom ...	1,228,000	87,000	–1,141.000
„ United States ...	179.000	103.000	– 76,000
„ Belgium	*	87,000	—
Accumulators, batteries, electrodes in combination with rubber or celluloid—			
Total	1,252,000	1,676,000	+ 424,000
From Germany	558,000	702.000	+ 144,000
„ Italy	65,000	120,000	+ 55,000
„ France	322,000	400,000	+ 78,000
„ United States ...	113.000	71,000	– 42,000
„ Austria	69,000	95,000	+ 26,000
„ United Kingdom ...	104,000	262,000	+ 158,000
Accumulators, &c. (other)—			
Total	166.000	224,000	+ 58,000
From Germany	57,000	94,000	+ 37,000
„ France	45,000	57,000	+ 12,000
Steam engines, cranes, pumps, turbines, &c.—			
Total	499,000	475,000	– 24,000
From Germany	266,000	401,000	+ 135,000
„ United Kingdom ...	90,000	48,000	– 42,000
„ France	39,000	5,000	– 34,000
„ United States ...	81,000	8,000	– 73.000
Electric arc lamps—			
Total	30,000	28,000	– 2,000
From Germany	29,000	27,000	– 2,000
Electric incandescent lamps, mounted—			
Total	2,241,000	2,400,000	+ 159,000
From Germany	381,000	636,000	+ 255,000
„ Austria	132,000	184,000	+ 52,000
„ Holland	1,488,000	1,274,000	– 214,000
„ France	76,000	96,000	+ 20,000
„ Hungary	134,000	183,000	+ 49,000
Insulators, mounted—			
Total	409,000	119,000	– 290,000
From Germany	180,000	88,000	– 92,000
„ United States ...	80,000	7,000	– 73,000
„ Denmark	137,000	10,000	– 127,000
Electric meters—			
Total	500,000	571,000	+ 71,000
From Germany	445,000	504,000	+ 59,000
„ France	30,000	38,000	+ 8,000
Telegraph and telephone apparatus—			
Total	3,220,000	5,923,000	+2,703,000
From Germany	1,916,000	3,342.000	+1,426,000
„ United Kingdom ...	334,000	512,000	+ 178,000
„ Sweden	149,000	12,000	– 137,000
„ France	402,000	484,000	+ 82,000
„ Belgium	332,000	1,318,000	+ 986,000
Electrical apparatus not elsewhere mentioned—			
Total	2,471,000	4,426,000	+1,955,000
From Germany	1,436,000	1,913,000	+ 477,000
„ France	167,000	324,000	+ 157,000
„ United Kingdom ...	599.000	1,808.000	+1,209,000
„ United States ...	56,000	57,000	+ 1,000

Exports.

	1924. Fr.	1925. Fr.	Inc. or dec. Fr.
Dynamo-electric machines and electric transformers of all kinds—			
Total	24,159,000	28,077,000	+3,918,000
To Germany	450,000	1,986,000	+1,536,000
,, Austria	279,000	688,000	+ 409,000
,, France	3,741,000	4,133,000	+ 392,000
,, Italy	523,000	2,313,000	+1,790,000
,, Belgium	1,964,000	1,479,000	– 485,000
,, United Kingdom ...	1,940,000	1,520,000	– 420,000
,, Egypt	406,000	383,000	– 23,000
,, Spain	2,961,000	2,572,000	– 389,000
,, British India	152,000	223,000	+ 71,000
,, Poland	878,000	1,460,000	+ 582,000
,, Rumania	149,000	249,000	+ 100,000
,, Colombia	*	18,000	—
,, Brazil	593,000	1,101,000	+ 508,000
,, Argentina	669,000	1,074,000	+ 405,000
,, Netherlands	1,121,000	1,170,000	+ 49,000
,, Norway	1,485,000	922,000	– 563,000
,, Netherlands Indies ...	172,000	311,000	+ 139,000
,, China	541,000	196,000	– 345,000
,, Japan	2,061,000	1,570,000	– 491,000
,, Peru	665,000	336,000	– 329,000
,, Australia	*	654,000	—
Accumulator batteries, electrodes in combination with rubber or celluloid—			
Total	184,000	164,000	– 20,000
To France	68,000	47,000	– 21,000
,, Italy	57,000	38,000	– 19,000
,, United Kingdom ...	—	1,000	+ 1,000
,, Poland	*	1,000	—
,, Germany	*	30,000	—
Accumulators, &c. (other)—			
Total	59,000	145,000	+ 86,000
To France	10,000	6,000	– 4,000
,, Italy	1,000	1,000	—
,, United Kingdom ...	17,000	74,000	+ 57,000
,, Brazil	*	27,000	—
Insulators, mounted—			
Total	198,000	109,000	– 89,000
To Germany	25,000	14,000	– 11,000
,, France	19,000	7,000	– 12,000
,, Italy	73,000	58,000	– 15,000
,, Spain	51,000	5,000	– 46,000
,, United Kingdom ...	*	2,000	—
Electric cable, not insulated—			
Total	1,432,000	1,433,000	+ 1,000
To France	278,000	436,000	+ 158,000
,, Austria	137,000	95,000	– 42,000
,, Italy	83,000	33,000	– 50,000
,, United Kingdom ...	705,000	660,000	– 45,000
,, Norway	24,000	22,000	– 2,000
,, Jugo-Slavia	138,000	34,000	– 104,000
,, Czecho-Slovakia ...	*	53,000	—
Insulated cable, not lead covered or iron armoured—			
Total	1,311,000	919,000	– 392,000
To France	31,000	25,000	– 6,000
,, United Kingdom ...	960,000	701,000	– 259,000
,, Denmark	75,000	5,000	– 70,000
,, Austria	40,000	14,000	– 26,000
,, Sweden	22,000	16,000	– 6,000
,, Hungary	42,000	19,000	– 23,000
,, Egypt	*	45,000	—
,, Peru	37,000	*	—
Cable, lead covered—			
Total	52,000	16,000	– 36,000
To France	*	10,000	—
,, Rumania	49,000	*	—
Cable, lead-covered and iron armoured—			
Total	84,000	35,000	– 49,000
To Rumania	68,000	*	—
,, France	1,000	*	—
,, Jugo-Slavia	*	14,000	—
,, China	*	10,000	—
,, Brazil	*	1,000	—
Cable, insulated with rubber or paper and covered with textiles—			
Total	151,000	322,000	+ 171,000
To France	35,000	40,000	+ 5,000
,, Belgium	54,000	172,000	+ 118,000
,, Great Britain	*	35,000	—
,, Denmark	*	55,000	—
Electric locomotives—			
Total	3,935,000	2,141,000	–1,794,000
To Dutch East Indies ...	640,000	*	—
,, United Kingdom ...	*	156,000	—
,, South Africa	3,037,000	*	—
,, Japan	237,000	490,000	+ 253,000
,, France	*	1,489,000	—
Telegraph and telephone apparatus—			
Total	481,000	582,000	+ 101,000
To France	51,000	80,000	+ 29,000
,, Italy	8,000	68,000	+ 60,000
,, Germany	63,000	78,000	+ 15,000
,, Spain	30,000	14,000	– 16,000
,, Dutch East Indies ...	121,000	40,000	– 81,000
,, Greece	*	25,000	—
,, United Kingdom ...	80,000	39,000	– 41,000
Electric incandescent lamps, unmounted—			
Total	31,000	4,000	– 27,000
To France	31,000	1,000	– 30,000
Electric incandescent lamps, mounted—			
Total	2,276,000	2,300,000	+ 24,000
To Austria	15,000	1,000	– 14,000
,, France	725,000	1,060,000	+ 335,000
,, Italy	1,277,000	1,080,000	– 197,000
,, Portugal	—	2,000	+ 2,000
,, Germany	19,000	26,000	+ 7,000
,, Norway	64,000	19,000	– 45,000
,, Algeria	*	1,000	—
,, Greece	*	36,000	—
,, United Kingdom ...	32,000	23,000	– 9,000
Electric meters—			
Total	10,190,000	12,300,000	+2,110,000
To Germany	164,000	565,000	+ 401,000
,, Austria	285,000	265,000	– 20,000
,, France	2,385,000	2,733,000	+ 348,000
,, Italy	813,000	1,119,000	+ 306,000
,, United Kingdom ...	783,000	1,337,000	+ 554,000
,, Belgium	1,031,000	1,301,000	+ 270,000
,, Spain	905,000	1,035,000	+ 130,000
,, Japan	1,325,000	727,000	– 598,000
,, Netherlands	143,000	340,000	+ 197,000
,, Czecho-Slovakia ...	286,000	565,000	+ 279,000
,, Australia	759,000	467,000	– 292,000
Steam engines, cranes, pumps, turbines, &c.—			
Total	15,117,000	14,480,000	– 637,000
To Germany	284,000	286,000	+ 2,000
,, France	1,816,000	2,354,000	+ 538,000
,, Belgium	3,470,000	2,170,000	–1,300,000
,, Holland	955,000	592,000	– 363,000
,, British India	56,000	344,000	+ 288,000
,, Japan	2,391,000	989,000	–1,402,000
,, United Kingdom ...	2,860,000	1,560,000	–1,300,000
,, Spain	258,000	396,000	+ 138,000
,, China	219,000	118,000	– 101,000
,, Argentina	332,000	1,746,000	+1,414,000
,, Egypt	2,420,000	152,000	–2,268,000
,, Rumania	91,000	79,000	– 12,000
,, Russia	103,000	89,000	– 14,000
,, Portugal	40,000	17,000	– 23,000
,, Colombia and Chile ...	323,000	211,000	– 112,000
,, Chile	*	210,000	—
Electrical apparatus not elsewhere mentioned—			
Total	9,333,000	10,136,000	+ 803,000
To Germany	141,000	423,000	+ 282,000
,, Austria	183,000	468,000	+ 285,000
,, France	1,887,000	1,504,000	– 383,000
,, Italy	418,000	658,000	+ 240,000
,, Belgium	1,650,000	1,408,000	– 242,000
,, Netherlands	365,000	401,000	+ 36,000
,, United Kingdom ...	396,000	466,000	+ 70,000
,, Spain	1,171,000	833,000	– 338,000
,, Portugal	154,000	168,000	+ 14,000
,, Norway	90,000	101,000	+ 11,000
,, Czecho-Slovakia ...	373,000	469,000	+ 96,000
,, Egypt	185,000	232,000	+ 47,000
,, China	187,000	62,000	– 125,000
,, Japan	315,000	334,000	+ 19,000
,, United States	431,000	1,110,000	+ 679,000
,, Argentina	96,000	271,000	+ 175,000
,, Peru	310,000	36,000	– 274,000
,, Rumania	130,000	60,000	– 70,000
,, Poland	198,000	230,000	+ 32,000

* Not specified.

Severn Barrage.—A point of interest emerged from the statement made in Parliament on July 14th by Colonel Ashley, Minister of Transport. In moving the vote for his department he explained that £20,000 had been placed on the estimates for continuing investigations of the Severn Valley barrage scheme. Col. Ashley urged the possibility of utilising the tides in the Severn Channel without hurt to the ports there, and said: "If immense energy can be released to create electricity in this country, surely no one in the House will grudge the £20,000." He added that it would be three or four years before the real practicability of the project could be decided.

Low-Frequency Intervalve Transformers.

The Experimental Verification of Theoretical Aspects, and a Low-Leakage Transformer.

By P. W. WILLANS, M.A.

(*Abstract of paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE general principles on which voltage amplifiers operate have been known for a considerable length of time, but the special problem of designing a transformer to operate in conjunction with a valve so as to constitute a uniform voltage amplifier over the important range of audio frequencies has not until recently been adequately dealt with in any published work.

The author's only reasons for presenting the present paper are, first, that the method of measurement employed by him throughout the work is possibly novel,* and, secondly, that some aspects of the problem of designing an intervalve transformer need emphasis; his work was carried out in 1923 for the Marconiphone Co. and, had it not been for commercial reasons, publication would have taken place some considerable time ago.

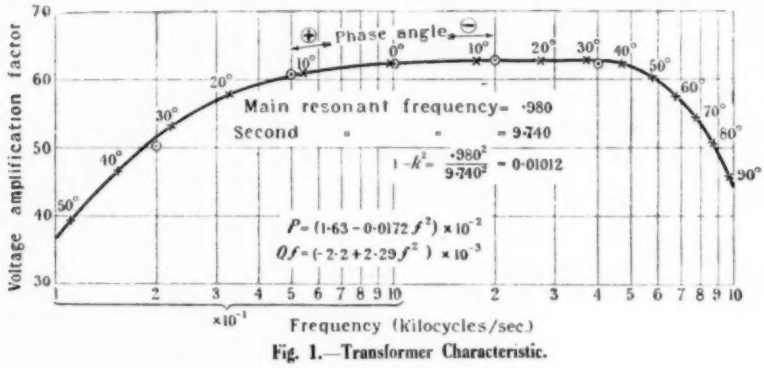

Fig. 1.—Transformer Characteristic.

The theoretical expression for the voltage amplification of a valve followed by a transformer is developed in its simplest possible terms, and various particular cases are considered. The importance of low leakage inductance for the uniform amplification of the higher frequencies is emphasised and practical verification of the theory is provided by measurement of the vector amplification ratio and comparison with the theoretical equations; graphical methods are indicated whereby the constants of a transformer can be deduced from these measurements and the amplification ratio extrapolated to frequencies beyond the range of convenient measurement. The conclusions to be drawn from the theoretical discussion of the problem may be summarised as follows:—

(i) The performance of a single-stage transformer amplifier may be expressed as a vector voltage amplification ratio consisting of a fraction having a numerator independent of the frequency and a denominator consisting of a real part X and an imaginary part Y, both in general varying with the frequency.

(ii) Term Y vanishes for a certain frequency (the resonant frequency) which is determined mainly by the inductance L_2 and capacity C_2 of the secondary winding. The extent of the variation on either side of this frequency is determined by the ratio C_2/L_2, the step-up ratio σ, and the valve resistance ρ, the constancy being greater the smaller the values of these quantities. The values of Y are identical for any two frequencies bearing inverse ratios to the resonant frequency. So far as the design of the transformer is concerned, it is of importance that C_2 and $1/L_2$ should be separately made as small as possible; the value of σ can then be adjusted in conformity with ρ so that the required degree of constancy of Y is attained.

(iii) Term X vanishes for a certain frequency which is dependent upon the secondary leakage inductance l_2, capacity C_2, and resistance r_2. The variation of X at frequencies higher than this critical frequency is very steep, but its value tends to constancy at low frequency. The lower the values of l_2, C_2 and r_2 the higher is the frequency for which X vanishes, but a low value of r_2 impairs the efficiency of the transformer.

(iv) Since the constancy of X is not governed by σ, one cannot ensure constant amplification by a reduction in ratio: the best that can be achieved is the adjustment of σ until $(X^2 + Y^2)$ is constant over a band of frequencies, but the width of this band is determined by the degree of constancy which has been achieved for X.

(v) Setting aside the alternative of applying a damping resistance to the transformer windings, the problem of intervalve transformer design therefore resolves itself into increasing the secondary inductance to the utmost extent and, at the same time, reducing to the lowest limits the secondary capacity and the secondary leakage inductance, which necessitates a determination of the winding space occupied by the primary winding, but not of the number of turns with which this space is filled.

We are then left with the value of the step-up ratio at our disposal and we are enabled to adjust this so that in conjunction with any given valve and, within limits, operating into any given impedance, a voltage amplification characteristic will be obtained of the greatest possible constancy.

The practical transformer finally developed by the author and Mr. M. Ward, B.Sc., his assistant and co-patentee, (wherein low leakage inductance and self-capacity are ensured by means of sectionalised and spaced construction) was the result of an attempt to obtain the utmost constancy without the employment of damping resistance. Theory shows that in order to achieve this object we must reduce both l_2 and C_2 to the utmost possible extent and, whilst the importance of low self-capacity had been stressed in published work and in manufacturers' advertisements, the question of leakage inductance did not appear at the date of the specification (December 17th, 1923) to have received the attention it deserved.

The reason seemed to be two-fold: first, that on the analogy of power transformers one would suppose that the coefficient of coupling could be reduced well below 1 per cent. simply by attention to the iron circuit; secondly, that in cases where it was clearly realised that a considerable percentage of leakage existed, it was actually considered a desirable characteristic inasmuch as it counteracted the effects of self-capacity. The exacting requirements of faithful reproduction in broadcast reception indicated, however, that something further was required than merely the limited range of straight characteristic obtainable with a transformer constructed on normal lines, and the quality of reproduction in the upper register which was obtained as a result of the modified design appeared to justify this view.

In order to reduce the value of leakage inductance the customary method was adopted of dividing the primary and secondary windings into sections and interleaving them, first attempted without any special precautions, but it was immediately found that the mutual capacity between primary and secondary gave a very heavy drop in the value of Y at high frequencies. Accordingly, the sections were spaced apart from each other until no appreciable gain in respect of capacity was obtained by spacing them any further, and the result was a transformer having the characteristics shown in fig. 1.

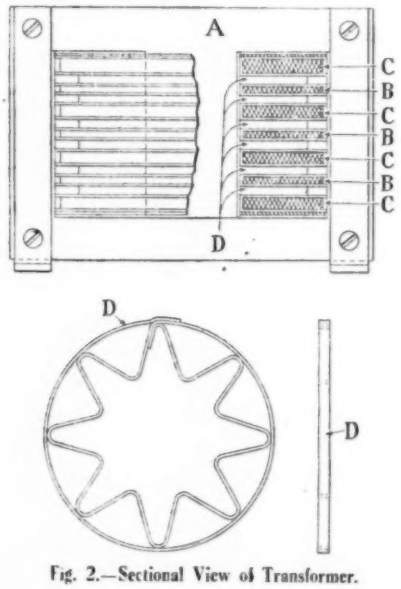

Fig. 2.—Sectional View of Transformer.

A sectional view of the transformer is shown in fig. 2; sections C consisted in all cases of about 5,000 turns of 44 S.W.G. enamelled wire, but the gauge and number of turns of the sections B varied according to the ratio of the transformer.

* See ELEC. REV., February 12th, 1926; p. 276.

In order to space the sections apart from each other, star-shaped spacing-pieces of the kind shown in the figure (reference D) were used, made of strips of thin millboard situated edgewise on; other methods have also been adopted to give an equivalent effect.

A shell-type iron core was employed consisting of T-shaped and U-shaped Stalloy laminations lapped in the usual manner and secured by bolts passing through the corners; it is worth noting in passing that there was no perceptible advantage of any kind to be obtained by not punching the laminations in this manner, nor did it appear to make any difference whether the bolts were insuluated or not. The cross-section of the iron core was about 5.5 cm² and the length of the iron circuit 18 cm. The average effective shunt resistance across the secondary winding has been worked out from a set of circle diagrams of primary impedance furnished to the author by Mr. E. C. Cork; its value was approximately 8 megohms, though it varied somewhat with different transformers. In view of the fact that it was necessary that the resistance thrown into the secondary winding from the anode circuit of the valve should have a value of the order of 0.25 megohm, it will be realised that no very great gain was to be expected by improving the transformer in respect of losses, and this would appear to account for the point mentioned above regarding the bolting of the laminations.

The secondary inductance of these transformers was of the order of 300-350 H and the coefficient of coupling was about 1 per cent. The latter varied slightly with different ratios of transformer, an improvement being found in the case of the lower ratios where the density of primary winding was greater; the variation was probably due to the different gauges of wire used and the different manner in which the winding space was filled up.

Four different ratios of transformer were specified. The lowest of 2.7 : 1 was suitable for use in conjunction with valves having an impedance of about 40,000 ohms, such as the ordinary "R" type. The transformer of ratio 4 : 1 operated very satisfactorily in conjunction with a valve of about 16,000 to 18,000 ohms' impedance; the 6 : 1 ratio with a 7,000-ohm valve, and the 8 : 1 with a valve of 4,000 to 5,000 ohms' impedance. The last-mentioned transformer is also useful after a crystal rectifier, though it is doubtful whether it has a sufficiently high step-up ratio for some of the very low-resistance crystals.

All the above transformers appear in general use to offer one very definite advantage, namely, comparative immunity from reaction effects tending to self-oscillation or distortion. It has been the belief of the author for some time that a transformer of low leakage inductance is inherently more stable in cascade amplification, and measurement of the effect of the impedance of the windings of one transformer on the amplification of another (due to the grid-filament capacity of the valves) appeared to support this contention.

There appears also to be some justification for the view that actually better reproduction is given with a low-leakage transformer amplifier on frequencies, say, up to 5,000 cycles than with transformers of the ordinary type which are carefully adjusted to give a uniform amplification curve up to this frequency and no further. At any rate it appears desirable, for really good quality reproduction, to place the second resonance of the transformer at the very highest possible frequency, and a value of 8,000 to 10,000 cycles does not appear by any means to be excessive. The transformer whose characteristic is shown in fig. 1 has a second resonance of 9,740 cycles.

The defect of the transformer characteristic under consideration is undoubtedly the inefficient reproduction of the lower frequencies, and it is of interest to note that, in a transformer embodying the same principles of design which has been recently developed and put on the market, this deficiency has been made good with very little sacrifice on the upper register.

Various questions relating to intervalve transformers are briefly considered and circuits are described for increasing the amplification of low frequencies and the effective step-up ratio of the transformer. The use of low-frequency reaction for correcting distortion is described and illustrated by measurement, while in conclusion the choice of a valve is referred to. The peak amplification is proportional to the square root of the amplification factor of the valve and it appears that a very considerable gain is to be expected from the employment of a valve of high magnification factor and a transformer of conservative step-up ratio; there seems to be little doubt that if a valve could be produced having an impedance of the order of 0.25 megohm and a proportionate amplification factor, the best form of intervalve coupling would be of the choke type. This, however, neglects practical difficulties, such as battery supply, which must of necessity enter into any consideration of this kind.

As an offset to the advantages gained by the employment of a valve of high magnification factor it is worth while remarking that it is very difficult to produce such a valve with a sufficiently straight characteristic to avoid asymmetric distortion on the high and low frequencies respectively. The use of such valves is thus of greater advantage in the earlier stages of an amplifier where the voltage amplitude is small. A further question that must also be considered is the greater effect of inter-electrode capacity in a valve of this kind, since the capacity is at least as great as, if not greater than, that of open-mesh valves, and the voltage developed across this capacity is of course considerably greater.

South African Municipal Electrical Engineers.

A Review of the Proceedings at the Seventh Convention.

THE *South African Engineer* contains a full account of the seventh Convention of the Association of Municipal Electrical Engineers (S.A.), which was held in Johannesburg on April 12th to 16th (ELECTRICAL REVIEW, June 4th, p. 830). In the address of the retiring president, Mr. John Roberts, M.I.E.E. (Durban), he referred to the encouraging signs of a forward movement in the electricity supply industry in South Africa. Loads were building up in a most satisfactory manner and there was every indication that the electrical industry was sharing in that country the prosperity which it had enjoyed all over the world since the conclusion of the Great War. The problem was no longer how to turn out the kWh cheaply enough from the stations, but how to get it to the consumer without involving such expenses in distribution as would add too greatly to its cost by the time it was metered on his premises. Mr. Roberts also touched on the work of electrifying the South African railways. The equipment of the section of the Natal main line between Glencoe and Pietermaritzburg was nearly finished, and was accomplishing all, if not more than, was expected from it in the increased volume and speed of the traffic dealt with.

The new president, Mr. B. SANKEY (Johannesburg), in his address outlined the activities of the Association during the ten years since its inauguration. The question of standardisation had always held a foremost place in the deliberations of the Association. His Excellency the Governor-General had, under powers vested in him, made the following regulation: "The standard pressures at consumers' terminals shall be 220/440 V for d.c. systems and 220/380 V for 3-phase, a.c. systems." While Mr. Sankey regretted that a pressure had been chosen which was not standard either in Great Britain or in America, but represented the Continental standard, he felt it was the duty of the Association to accept it and to take measures without delay to bring the undertakings for which it was responsible into line, and to assist in any scheme which might be suggested for that purpose. The president briefly reviewed the present electrical position in South Africa. There were at present sixty-five municipal undertakings in the country running generating stations, thirteen which purchased bulk supplies, and two private companies. The municipalities between them operated 96,901 kW of generating plant with a total peak load of 52,801 kW, equal to 54 per cent. of the plant capacity. Taking the value of the generating plant at £20 per kW, the value of the reserve plant was £882,960. The total kWh sold by the municipal undertakings amounted to 150,643,000, and they served 101,900 consumers. One of the difficulties with which the municipalities were faced was the provision of electricity in outlying areas, and the undertakings were often forced by pressure of public opinion to lay mains and to provide supplies in areas where such supplies could not possibly reach the profit-earning stage for many years to come, but had to be given at a loss, and the tariffs and charges of the municipality had to be such that the loss was made good by the supplies in the more profitable areas. In dealing with the question of the large generating station, Mr. Sankey said, without particularising, it might be stated that Government engineering undertakings established in recent years had not created a reputation for low capital costs. Those who were more practically interested in the development of the industry had watched closely the evolution of the large stations in Great Britain, and had patiently waited to observe the effect of the much discussed economies on either the balance sheet or the tariff scale, but in vain. The moderately sized stations still led the way, both in low cost and, what was of more importance, in low charges. The bait held out to the consumers of electricity, *viz.*, that as soon as super stations had been established they would have energy supplied at about 1d. per kWh, had not so far eventuated. On the subject of electricity for domestic purposes, he said that it was essential to put the goods before the public and the most effectual way in which to educate the public in the uses of electricity was by the establishment of centrally situated showrooms.

A very interesting paper on "Alternating Current Substations and their Equipment for Urban Areas," by Messrs. A. T. Rodwell, M.I.E.E. (Johannesburg), and P. Fraser, A.M.(S.A.)I.E.E. (Johannesburg), was presented during the Convention. The authors outlined the general practice in South Africa in this direction, and made a number of suggestions for improvements in the design and equipment of substations. The question of building transformer sub-stations underground was not discussed as it was felt to be a decided retrograde step which should only be taken under extreme

pressure and then only as a temporary measure. For the sake of standardisation of sub-station buildings and internal layouts, a suitable design could be got out applicable to any district, and suitable external refinements to correspond or harmonise with neighbouring buildings could always be incorporated when required at a small cost. In Johannesburg, in areas where the load to be dealt with was small, it was customary to erect kiosks. These were constructed of sheet steel, and suitably braced and designed to each house a maximum of 100 kVA in transformer equipment, complete with the necessary h.p. and l.p. switchgear and fuses. They were of robust design and possessed a neat and pleasing appearance when erected. They proved of great value for developing a growing load where the expense of brick or substantially erected buildings was not justified. They were easily transported and could be moved to a new site in a few hours at very little cost. Another valuable feature of the transformer kiosk was that where a suitable plot of ground was not obtainable for the erection of a sub-station, a kiosk, provided it could deal with the demand, could be erected on the footpath or an "island" in the centre of the road. No objections had been lodged against this type of structure. Referring to the question of installing automatic time controlled switchgear in sub-stations for the purpose of putting additional transformers on circuit in times of heavy load, and thus reducing the transformer capacity, and hence the transformer losses, on light load, the authors said that the capital expenditure and subsequent maintenance and supervision for a system so equipped would be heavy, and serious consideration to the probable savings in losses, as against the outlay, must be given, as the losses which it was proposed to save were often more apparent than real.

The authors advocated the use of the outdoor sub-station where the pressure exceeded 33 kV, but not where the pressure was below this figure. Outdoor equipment for pressures from 3,300 to 11,000 V required well over double the space necessary for an equivalent indoor equipment. Where the pressure exceeded 33 kV, however, and ground could be purchased cheaply, the outdoor sub-station was the better commercial proposition. In dealing with the question of the protection of the public against electrical dangers, the authors regretted that in many cases the owners of property would only alter defective apparatus and install satisfactory equipment upon the possibility being pointed out to them of the insurance companies refusing to take fire risk or accept liability for damage from this cause. In dealing with the installation of reactances on distribution systems for limiting short-circuit currents, they pointed out that a reactance improperly proportioned might aggravate rather than minimise the trouble. In the discussion which followed the paper, it was suggested that the kiosk was unsuitable, as the necessary operations had to be effected from the outside; also that in some cases where they had been erected on road "islands," they had in less than three years become too small to meet the developments.

Mr. H. M. S. MULLER read a paper, "Notes on the Merits of Suction Gas Engines as Prime Movers in Municipal Power Stations," in which he defended the well-designed suction gas plant from the point of view of reliability, as compared with oil or steam plant.

Mr. B. SANKEY also read a paper, "Memorandum on Licensing of Electricians, Wiring Rules and Regulations and Municipal Bye-Laws," which resulted in a very lengthy and interesting discussion. The paper, which incorporated a copy of a Bill drafted by the Johannesburg Electricians' Licensing Board, put forward a number of questions for consideration, as follows:—

(1) Is it necessary to have municipal bye-laws, rules and regulations covering the whole of the consumer's installation?

(2) If the answer to (1) is in the affirmative, should the municipal electricity undertaking or other supplier be required to undertake the expense and responsibility of enforcing these regulations?

(3) If the answer is in the negative, should not the standard set of regulations, as drafted by this Association, be revised to cover the undertaking's property only, together with such bye-laws as may be necessary to ensure the proper use of the electricity supplied to prevent leakage or interference with the supply to other consumers?

(4) Does not the efficient and safe carrying out of an electrical installation more properly belong to private enterprise in the persons of the consulting engineer, architect, builder, fire insurance company and electrical contractor, and why should an electricity undertaking usurp its functions and spend large sums of money in doing so?

(5) Is there any necessity for, or obligation upon, an undertaking to seek to enforce the government mines and machinery regulations, except with regard to its own apparatus on a consumer's premises?

A great number of different views were expressed in the discussion, but the main issues seem to have been those of whether or not all wiremen should be licensed, and the practice of the inspection of installations by the municipalities maintained. Generally, the expressed opinion was that licensing was unnecessary, and that the undertakings should be responsible for the inspection of all installations. It was pointed out that the cost of the inspection service in Johannesburg was only 0.01d. per kWh sold, and that if the consumers got a rebate to this extent they would not appreciate it if they knew that they were not getting the assistance of the Council's inspectors to see that their installations were in order.

A number of works visits were carried out during the Convention, including one to the Rosherville power station of the Victoria Falls and Transvaal Power Co., Ltd. On that occasion Mr. BERNARD PRICE, O.B.E., manager and chief engineer of the company, addressed the members and outlined the activities of the undertaking. The Witbank station, which was being built by the company, was being purchased, as it was being built, by the Electricity Commission, by which it would be owned. The company would operate the station for a period, at any rate, and had undertaken to purchase the entire output of the plant, other than the small portion which the Commission would itself require for supplying its consumers in the Witbank area. When the new station was running the system would comprise five generating stations with 400,000 h.p. of plant installed, feeding about 100 sub-stations. The load was characteristically one of high load factor—well over 70 per cent., and the air supply was unique. On the peak 500 tons of compressed air per hour was sold, and 5,000 tons was distributed at a pressure of from 110 to 120 lb. during each 24 hours. Including the supply of air, the total kWh sold amounted to well over 1,000,000,000 per annum, and the maximum demand on the system was more than 200,000 kW. The scheme was the largest of its kind in the British Empire, and, when Witbank was running, the mining groups would receive energy at under 0.45d. per kWh.

The report and balance sheet of the Association for the period from November, 1924, to March, 1926, were presented during the Convention. At the end of the period under review the total membership of the Association was 50. The revenue for the period amounted to £295, and the expenditure resulted in a balance of £87.

The London County Council Tramways.

Finance and Fares.

IN our last issue we gave a brief summary of the financial results of the working of the L.C.C. Tramways for the past year, showing that a deficit of £114,629 was incurred. The report of the Highways Committee containing these figures shows that the length of route operated at March 31st last was 164.44 miles. The car-mileage run increased from 68,068,216 to 68,530,795 and the number of passengers carried from 682,595,733 to 690,222,969. Both the receipts and expenditure per car-mile decreased, the former from 14.63d. to 14.53d., and the latter from 14.08d. to 13.56d. The passenger traffic receipts were practically the same at £4,148,998. The total net capital expenditure on the undertaking up to March 31st last was £16,874,893, and the amount of debt incurred up to that date was £17,246,967. Taking into account repayments, sinking fund balances, &c., the net debt outstanding was £9,110,378. The average sum devoted to the redemption of debt during the last eight years has been £331,480, while interest charges have averaged £275,668 during the same period. At the same time, the annual estimated saving to road authorities in consequence of the obligation of the Council to maintain the paving along the tramway routes has been in the neighbourhood of £250,000. The amount of capital expenditure which, up to March 31st last, had become obsolete owing to the electrification of the horse tramways, was £2,024,687, but by the process of repayment, &c., this had been reduced to £735,312. The outstanding debt in respect of obsolete capital expenditure on electric traction amounts to £170,921. Other relevant figures are the amount of rates on the permanent way, £60,822 in 1925-26, and averaging £80,000 for the last eight years; and street-widening charges, £30,456 last year and an average of £31,000 for the past eight years. The Highways Committee's estimates of the results of the current year's working provide for a net deficiency of £127,330 after allowing £381,842 for debt interest and £177,211 for repayment.

When these estimates were presented, the Committee undertook to investigate the possibility of effecting a number of improvements and rearrangements suggested by members of the Council. These matters formed the subject of a report which came before the Council last week, and the following in a *résumé* of the Committee's findings: The lower saloon of a standard bogie car has been equipped with transverse cushioned seats to enable as many of the passengers as possible to sit facing in the direction of travel. As a result of an inspection of this car, it has been decided to similarly equip a further 100 cars. The cleaning of cushioned cars has been provided for and the lighting has been improved. A considerable addition to the number of lamp points is being made in new or re-equipped cars, and white enamel paint is being used for the ceilings and parts of the sides in place of the varnished timber surface. The Committee does not consider it possible to institute a 6d. "all-day" ticket for children on the lines of the 1s. tickets for adults, but a partial concession in this direction is being discussed. The provision of a number of additional circular routes was suggested, but as these would involve the running of additional unremunerative mileage and duplication, the Committee does not consider that the suggestion can be adopted. Another proposal was that transfer facilities should be extended to all routes. The Committee points out that it reported on this subject unfavourably last year, and nothing has arisen since

to warrant any change of view. It has also previously reported in an adverse sense upon the suggested issue of weekly season tickets, and is unable to alter its decision. It states that by the issue of 1s. all-day tickets, reduced return fares and cheap mid-day fares, the Council, in effect, already gives the fare advantages of a season ticket at a daily rate and in many respects the system is superior to the railway season-ticket system. The same arguments apply to another suggestion—the issue of quarterly, half-yearly, and yearly tickets. With regard to the adoption of intermediate ½d. fares, the Committee estimates that the risk of loss from this would be about £420,000 a year; this could only be compensated for by a 10 per cent. increase in traffic, and the risk cannot be undertaken. The Committee thinks that a 1d. minimum fare is reasonable, having regard to the present value of money. A further suggestion was made that Parliamentary authority should be sought for the construction of tramways to the Crystal Palace. In this connection the Committee points out that since 1906 various steps have been taken without success. At present, however, conditions are such that all charges could not be met. Nevertheless, the Committee is giving the matter further consideration in connection with proposals for new tramways in the session of 1927. Through running to Kingston and Hampton Court and with the Erith, Bexley, and Dartford tramways was another proposal. The Committee says that a through service to Hampton Court, *via* Wimbledon, on Saturday afternoons, Sundays, and bank holidays, was put into operation on May 22nd last. The question of through running with the Erith tramways has been under consideration since 1921. As, however, this would necessitate the reconstruction of the whole of the permanent way in Erith and the provision of new feeder cables, it has been decided to take no further action in the matter. A through-running arrangement with the Bexley and Dartford tramways has been in operation for some years.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

H.P. Supply from A.C. Mains.

In order to enable broadcast listeners to obtain high voltage from a.c. house service mains and avoid the use of valve-plate batteries, CLIMAX RADIO ELECTRIC, LTD., has placed upon the market a set of components which can be purchased, either complete and ready for use, or separately, and assembled by the user. The diagram (fig. 1) shows the terminal board of the transformer T, with its six terminals. Being double-wound and centre tapped, the transformer (fig. 3) enables double rectification to be employed and isolates the receiving set from the mains into which it is plugged by the two-pin adaptor shown. An additional winding is provided for lighting the filaments of the rectifying valves used in conjunction with it; each of the two valves can be given 1 amp. at up to 6 volts, thus making it possible to use bright "R"-type valves, which will furnish an h.p. output of about 40 milliamps. at voltages up to 150; if a larger output is desired, power, or special rectifying valves may be used. The anode winding of the transformer is designed to produce 400 volts in each section and a current of 75 milliamps. may be demanded without undue heating of the secondary winding. The two rectifying valves V are connected as shown in fig. 1 to the transformer T and

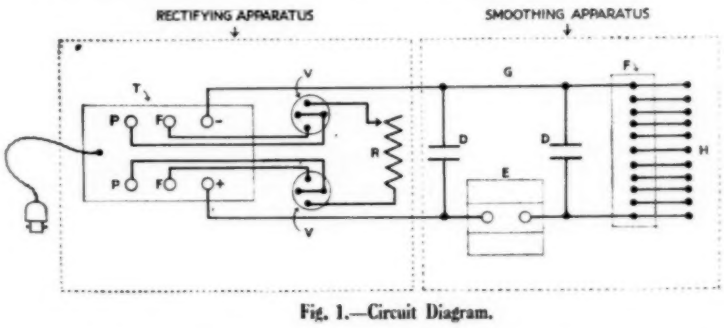

Fig. 1.—Circuit Diagram.

the 30-ohm dual rheostat R. The two high-grade fixed condensers D must be capable of permanently withstanding 300 volts; when little smoothing is required they can be of about 2 mfd. each and for excessive smoothing up to 8 mfd.; also a second choke similar to that at E should be included at G, and when a heavy output is needed two chokes in parallel will prevent magnetic saturation. The potential divider F has a number of tapping points H and consists of a 20,000-ohm resistance wound on a cylindrical former; R conveniently controls the maximum h.p. potential, while H give intermediate values. If the apparatus is to be used in conjunction with d.c. mains, care must be taken to make the transformer input of the right polarity. In this case the rectifying valves will, of course, not be needed, and the receiving set should be connected to earth through a 1- or 2-mfd. condenser.

A Coil Former.

It is not generally known that the products of the JEWEL PEN CO., LTD., include a range of radio-telephone accessories, which bear a "Red Diamond" registered trade mark. They are all made of turned or machined good-quality ebonite, no moulded parts being made use of at all, while all exposed metal portions are nickel plated. The range includes valve holders and coil mounts of various patterns, a permanent crystal detector, and plug-and-socket connectors, &c.

Fig. 2.—An Adjustable Coil Former.

A useful component takes the form of a "low-loss" coil former, of which we have a sample. Its construction is shown by fig. 2, a feature being the provision made for adjusting the diameter of the former between 2¾ and 4¼ in. The device is made in two sizes, namely, 6¼ and 4 in. long.

A Novel Crystal.

At a meeting of the French Académie des Sciences lately held in Paris, M. J. Gayrel, in the course of a short paper, drew attention to the possible use of old accumulator plates as a source of radio detector crystals. He stated that during experiments he had found a fragment of bioxide of lead from an old battery plate to be equal, as a detector, to the most carefully selected galena crystal.

A Coil Mount.

One of the latest products of Messrs. J. J. EASTICK & SONS is an anti-capacity "Eelex" coil mount. Strength and rigidity are obtained, and provision has been made for mounting practically any kind of coil; the basket or slab patterns can be mounted as easily as a "honeycomb" coil, and their external appearance is always the same. The idea has been to eliminate solid material as much as possible, in place of which only good-quality fibre is used, so that the leakage is very small.

Fig. 3.—"Climax Auto-Bat" Transformer.

Electric Cooking at Ilford.—The Ilford electrical engineer and manager (Mr. A. H. Shaw) has sent us copies of a booklet which he has had prepared for the education of consumers and "prospects" in the virtues of electric cooking. The bulk of the pamphlet is devoted to testimonials from satisfied users of electric cookers in the Ilford area.

The Electricity (Supply) Bill.

The Proceedings in Committee.

(*Continued from page* 118.)

Further consideration was given by Standing Committee C of the House of Commons to the Electricity (Supply) Bill on July 12th. Sir Robert Sanders presided.

Clause 35 deals with the terms of purchase of a company taking a bulk supply of electricity. Mr. GROTRIAN (Hull, S.W., U.) moved to delete the proviso giving to the Electricity Commissioners the final decision, and to insert instead:—"Provided that if the company or the local authority is dissatisfied with any such determination by the Commissioners, the question shall be referred to the arbitration of a barrister (or in Scotland an advocate) appointed by the Minister of Transport from the appropriate panel set up under Section 4 of this Act, and the arbitrator may, if he thinks it expedient to do so, call in the aid of one, or more, qualified assessors and hear the case wholly, or partially, with the assistance of such assessors."

Col. ASHLEY, the Minister of Transport, said that this was not really a matter for a barrister; it was eminently a technical matter for the Commissioners.

The amendment was negatived and the Clause was agreed to, as were also Clauses 36 (Methods of Charge), 37 (Amendment of Schedule, &c.), and 38 (Minor Amendments).

The Committee then adjourned.

On July 13th, the Committee considered Clause 39 (Interpretation). The Committee agreed to define "generating station" as having "the meaning given thereto by Section 36 of the Electricity (Supply) Act, 1919, and not the meaning given thereto by Section 25 of the Electric Lighting Act, 1909." It was also agreed to define "capital charges" as having the following meaning: "(*a*) in the case of a local authority, the interest and sinking fund charges in respect of that capital; and (*b*) in the case of a company, interest on the capital at a rate equal to the average rate of dividends and interest paid by the company on its share and loan capital during the preceding year, so, however, that the rate shall in no case be less than five or more than six and a-half per cent. per annum, together with a charge for depreciation of such amount as may be determined in accordance with a scale fixed by the special order."

After a long discussion the Committee agreed to an amendment, which provides that the adjustment or ascertainment of price for power factor purposes shall be in accordance with the regulations to be prescribed by the Electricity Commissioners.

The Clause, as amended, was agreed to, as was Clause 40 (Short Title, &c.).

The Committee then considered the new clauses. Sir D. HOGG, Attorney-General, moved a new clause, which it had been agreed would take the place of Clause 30, giving powers to lop trees and hedges obstructing electric lines. Provision was made for notice to be given to the occupier of the land and to the owner, if he was known, and the recipient would have three weeks within which to give a counter-notice raising an objection; if he gave that notice, then the Minister of Transport was to hear both parties, and to make such order as he thought just. It was provided, also, that in lopping or trimming a tree or hedge it was necessary to do as little damage as could be, either to the tree or to anything underneath it, and that compensation was to be made for the damage done, and if damage was done to the land, that was to be made good at the same time. The Ministry of Transport, on the advice of the Electricity Commissioners, had concurred in this clause, which was agreed to.

Mr. R. HUDSON (Whitehaven, U.) moved the following new clause:—"(*Power to obtain statistics from all generators of electricity.*) It shall be the duty of any company, body, or person owning a generating station to furnish to the Electricity Commissioners, if so required and at such times and in such manner as the Commissioners may direct, reasonable particulars as to plant installed, electricity generated and used, and fuel consumed in respect of any such generating station." He said that the clause gave discretionary right to the Electricity Commissioners. It was not meant to apply to persons who had in their own houses private installations.

Sir J. NALL (Manchester, Hulme, U.) opposed the clause.

Sir D. HOGG was unable to accept the clause, which (and also some other new clauses) might overload the Bill and prevent its getting through the House of Commons. Any suggestions members might have for improving the general law relating to electricity might go to the Ministry of Transport, where they would be considered sympathetically, and a Bill might in time be introduced into Parliament to give effect to these improvements, and to make the law more satisfactory.

The new clause was negatived.

Sir F. HALL (Dulwich, U.) moved a new clause as follows:—"(*Exclusion of London Companies.*) Nothing in this Act shall derogate from or supersede the provisions contained in the agreements entered into between the companies, parties thereto, respectively, and the London County Council, and confirmed by the London Electricity (No. 1) Act, 1925, and the London Electricity (No. 2) Act, 1925."

Lt.-Col. MOORE-BRABAZON, Parliamentary Secretary to the Ministry of Transport, said that under the Bill the London position would still stand. It was hardly conceivable that the scheme of the Bill and the London scheme, both of which would be inspired by the Electricity Commissioners, would run counter to each other.

The new clause was withdrawn.

The following new clauses were agreed to:—

"(*Supply of electricity by railways, &c.*).—(1) It shall be lawful for the owners of any railway generating station to supply electricity therefrom to the owners of any other railway generating station upon such terms and conditions as may be respectively agreed between them, provided that no such supply shall be given under the powers conferred by this section without the consent of the Electricity Commissioners.

"(2) The Electricity Commissioners may, subject to the provisions of the Electricity (Supply) Acts, 1882 to 1922, and to the schedule to the Electric Lighting (Clauses) Act, 1899, by order authorise the breaking up of such roads, railways, and tramways as may be necessary for the purpose of such a supply

"(3) The provisions of the Electricity (Supply) Acts, 1882 to 1922, and of the schedule to the Electric Lighting (Clauses) Act, 1899, so far as they relate to the protection of the Postmaster-General, shall apply to any works for the supply of electricity under this section and in the application of those provisions the owners giving the supply of electricity under the provisions of this section shall be deemed to be undertakers, and nothing in this section shall affect any right or remedy of the Postmaster-General under the Telegraph Acts, 1863 to 1921."

"(*Provisions consequent on acquisition by the Board of generating station or main transmission line.*)—(1) Where a generating station or main transmission line, acquired by the Board under this Act or under any scheme made in pursuance of section 4 of this Act, is in course of construction, extension, or repair, the rights and liabilities of the former owners thereof under any contract for such construction, extension, or repair shall be transferred to the Board.

"(2) Where any generating station acquired by the Board under this Act contains any plant which forms an essential part of the distribution system of the former owners of the generating station, that plant shall, notwithstanding such acquisition, remain the property of such former owners, who shall, so long as electricity is supplied for distribution from that station, at all times have the right of access thereto."

"(*Adoption of Local Government and Other Officers' Superannuation Act, 1922.*)—The Board and any joint electricity authority, respectively, may, if it thinks fit, adopt the provisions of the Local Government and Other Officers' Superannuation Act, 1922, in the same manner as if the Board or such joint electricity authority, as the case may be, were a local authority within the meaning of that Act."

The Committee then adjourned.

On July 15th, Sir D. NEWTON (Cambridge, U.) moved a new clause to give authorised undertakers power to lay electric lines and apparatus in private streets.

Sir D. HOGG said that the new clause was unnecessary, and it was negatived.

Sir J. NALL moved a new clause with the object of giving power companies the right of asking that the whole of their undertakings might be purchased outright by the State.

Sir D. HOGG described it as a wrecking clause, and it was negatived.

An interesting discussion took place on a new clause moved by Mr. LOOKER (Essex, S.E., U.), which provided that a local authority should be able to sell electrical fittings, &c., and that the Ministry of Transport should appoint a committee consisting of representatives of local authorities, electrical contractors, and consumers to determine retail prices. He said that the clause would merely carry out the recommendations of the Weir Report, and it was now really time that this question was settled. This power was possessed by gas and water companies, and there was no logical objection to electrical authorities being in the same position. The clause would benefit the small consumer.

Sir D. HOGG raised no objection to it, and left the matter to a free vote.

Mr. HANNON (Birmingham, Moseley, U.) was opposed to municipal trading.

Sir COOPER RAWSON (Brighton U.) said that the Electrical Contractors' Association of Scotland opposed the clause. There were no fewer than 4,000 firms of small contractors in business, and municipal trading would smash them up. About 50,000 electricians would be handed over to municipalities, and when work was done by a municipality more men were required than if the work was done by a contractor.

Labour members supported the new clause, which, on a division, was defeated by 17 to 11. Sir D. HOGG did not vote.

Mr. CLARY (Newport, U.) moved a new clause enabling gas companies to act as distributors of electricity, and remarked that it was regrettable that up to the present there

had been so little co-operation between the gas and the electrical companies.

Sir D. HOGG accepted the new clause, which was agreed to, in spite of Labour opposition, by 30 votes to 9.

A new clause moved by Mr. R. HUDSON (Whitehaven, U.) to provide for the setting-up of a committee to investigate prices of electrical equipment was ruled out of order, and the Committee adjourned.

(To be continued.)

At a meeting of the Edinburgh Chamber of Commerce on July 13th, Professor Wm. Oliver reported for the Special Committee on the Electricity (Supply) Bill. As an ideal, he said, the scheme was admirable. Every one would be agreed on this point, provided they could be assured that they would have a cheap electricity supply, a somewhat doubtful point on the evidence available. It was therefore not the idea of the scheme which was open to question, but the means of its attainment. The powers conferred upon the Central Electricity Board by the Bill were autocratic to a degree and might bear hardly on efficient stations of standard frequency which had been carefully built up by individual initiative and foresight. In fact, never before had it been proposed to give such uncontrolled power to a Government Department. Continuing, he said it was difficult to understand how certain efficient undertakings, already supplying power at ½d., or even less, per kWh, would not require to increase their charges to the consumer. Within the municipality of Edinburgh the price per kWh at the present time for power in reasonable quantities was ¾d., with certain rebates for large quantities, but outside in the surrounding country areas, served by the Lothians Electric Power Co., the price was greater and depended on the maximum kVA demand, plus the kWh taken. In one factory of medium size in this area, within a few miles of Edinburgh, the price per kWh worked out at approximately 1¼d. Apparently, then, the industrial centres would be penalised in order to bring the rural price of energy down to the standard 1d. rate aimed at. The figure of 1¼d. just mentioned was far exceeded in more remote localities, where the price per kWh rose even to 1s. Those remote localities, however, only represented a very small proportion of the power-consuming area of Britain, and their effect on the scheme was not likely to be serious. The Professor referred to other points which the Committee, in its report, was bringing before the notice of the House of Commons Committee dealing with the Bill.

New Diesel-Electric Ships.

Details of Some Vessels Recently Constructed in America.

THE necessity for the employment of the electric drive on ships has not been conceded in this country, but the progress that has been made with the system in the United States has been so considerable that some note must be made of the fact.

Details of what is described as the "biggest motor fire-float," a novel vessel of 1,000-b.h.p. for use on the Houston Ship Canal, a large cotton-exporting port located 50 miles inland from the Gulf of Mexico, are to be found in a recent issue of the *Motor Ship*. The new vessel was built for fire protection along the water front, and whatever may be thought of Diesel-electric propulsion, for a special case such as that under consideration, where large pumps are needed at a time when little or no power is required for propulsion, there is obviously something to be said for the principle. It has been adopted on the new fire-float probably for the first time, and certainly so in such a large craft; actually the power is sufficient to drive a small tramp ship. The capital cost of the propelling plant was no doubt heavy, but the saving on the fuel bill will be substantial, compared with a steamer or petrol-engined boat, and immediate readiness for service is an asset which can scarcely be reckoned in terms of money.

An Electric Fire-Float.

The new fire-float, which was constructed by the Bethlehem Shipbuilding Corporation, Wilmington, is named *Port Houston*, and was launched in February, being 125 ft. 10 in. overall, with a beam of 27 ft. and a normal draught of 8 ft. 6 in. In the engine-room amidships is fitted the whole of the machinery, including the generating plant, electric propelling motors, and the electrically-driven pumps. One to port and one to starboard, are the two main Westinghouse generating sets, the dynamos being 350-kW, 500-volt, machines with 23-kW exciters, and the engines six-cylinder Winton four-cycle units, capable of developing 500 b.h.p. at 420 r.p.m. Between the two generating sets are the main fire pumps, each driven by a 410-b.h.p. motor at 1,750 r.p.m. The pumps have a capacity of 7,000 gallons of water per minute, against a head of 150 lb. per sq. in., and under certain conditions might absorb practically the whole of the power developed by the generators, and it might yet be necessary to manœuvre the boat, although not at high speed. With this in mind a third generating set has been installed, wholly for the purpose of allowing the propelling motors to be operated at moderate speed and thus manœuvre the craft. This generator has an output of 100 kW and is a double-armature 270-volt machine. The Westinghouse propelling motors are rated at 360 b.h.p. at 265 r.p.m., and speed control from zero to maximum can be effected either in the engine-room or in the pilot house, the Ward-Leonard system of transmission having been adopted.

There are five main nozzles, the largest and highest being on a tower some 30 ft. above the deck level and well above the funnel; there are two lower turrets amidships, the capacity of the nozzles varying from 3,100 to 1,100 gallons per minute. The total capacity of all of the nozzles is in the neighbourhood of 8,300 gallons per minute.

The "Steel Electrician."

The Federal Shipbuilding and Dry Dock Co. has constructed an interesting vessel for the United States Steel Products Co. She is named *Steel Electrician* and has a gross tonnage of approximately 1,700. The length is 250.3 ft., the beam 42.9 ft. and the depth 17.2 ft. The Diesel-electric drive is employed, three oil engines of the new London Ship and Engine Co.'s four-cycle type being coupled to generators supplying power to electric motors coupled to the propeller shaft.

A Triple-screw Electric Ferry.

The same journal also announces that construction is now proceeding on a large ferry boat to the order of the Golden Gate Ferry Co., of San Francisco. It will be double-ended, and the main machinery comprises three American Werkspoor-Diesel engines, each of 400 b.h.p. and driving a dynamo. There will be two propelling motors, one at each end, the power being 950 b.h.p., which is sufficient for a speed of 14 knots.

A 720-b.h.p. Tug.

An order has been placed by the Long Island Railroad Co., U.S.A., for a high-powered Diesel-electric tug. The hull will be built by the Staten Island Shipbuilding Co., and the propelling plant will comprise two 340-b.h.p. Ingersoll-Rand, four-cycle, six-cylinder oil engines of the cold-starting type. Each engine will be coupled to a Westinghouse generator, furnishing electric power for a propelling motor on a single shaft.

A 900-ton Oil Tanker.

For a vessel of 900 tons dead-weight capacity and equipped with machinery of 500 b.h.p., the utilisation of electricity as a medium for transmitting the power of an oil engine to the propeller would scarcely receive consideration in the United Kingdom, but the method has been adopted on a number of craft of this size and power recently built in America.

This is particularly the case with tankers, and an interesting example has lately been placed in service at San Francisco by the General Petroleum Corporation. It may be added that one of the main reasons for the utilisation of the electric drive is that electrically-operated cargo pumps are fitted, and the Diesel-driven generators supply power for them as well as for the propelling motors.

The *General*, which was built by the Bethlehem Shipbuilding Corporation at San Francisco, is now engaged in transporting fuel oil and petrol in San Francisco Bay. She has an overall length of 176 ft. 6 in., a beam of 32 ft. and a depth of 14 ft. The vessel carries about 900 tons deadweight, equivalent to about 6,000 barrels of oil, with all the machinery located aft.

The arrangement is somewhat curious, for the propelling motor is actually forward of the two generating units; the latter comprise two 250-b.h.p. "Atlas" Diesel engines of the four-cycle solid-injection type, with six cylinders, each coupled to a 145-kW, 250-volt, dynamo running at 275 r.p.m. A 20-kW, 115-volt, Westinghouse exciter is also driven off the same shaft, and the propelling motor is a Westinghouse shunt-wound machine of the double-armature type operating at 250 volts. It is capable of developing 350 s.h.p., and has a speed range from zero to 160 r.p.m., which variation is effected by means of variable-voltage control gear mounted on a pedestal in the pilot house. The same control can, if desired, be carried out from the switchboard in the engine-room. Either of the two armatures may be used separately for propulsion, and both brought into action when more than half power is needed. The power supply, or part of it, can be immediately transferred to the pump motors when required.

There are two cargo pumps, each driven at a maximum speed of 1,150 r.p.m. by a 60-h.p., 230-volt motor; the output is about 150 tons per hour. Naturally, all other auxiliary plant on the ship is electrically operated, the windlass and capstan being driven by 10-h.p. motors. A special feature of the auxiliaries (apart from the pumps) is that the power is not derived

from the main generators, but from the exciters, which are 115-volt machines. Other electrically-driven plant includes the steering gear, the fire and general-service and the ballast pumps. A small storage battery is installed for lighting the ship when no dynamos are running.

On trial a speed of nearly 8¼ knots was attained with the two generating engines developing a total of 456 b.h.p. and the propelling motor delivering 389 b.h.p. from which it may be gathered that the transmission loss amounted to 67 b.h.p., less a certain amount of power which was, no doubt, absorbed by the auxiliary machinery.

A Large Dredger.

The dredging plant of the Port of Portland, on the Willamette River, Oregon, has recently been augmented by the addition of a steel dredger of unusual size and power, which is equipped with Diesel-electric machinery and a delivery pipe 30 in. in diameter. According to the *Scientific American* the vessel is 236 ft. long with a 50-ft. beam and a displacement of 2,480 tons. The main installation consists of two 800-h.p. Diesel engines, each directly connected to a 540-kW direct-current generator, and two 900-h.p. marine-type Diesel engines, each connected to a 610-kW direct-current generator. The combined power is 3,400 b.h.p. and the consumption is 4½ barrels of oil per hour (full power). It is possible to stop one unit for repairs and still obtain about 80 per cent. efficiency with the remaining three. In the electric main drive are two 610-kW 500-volt d.c. generators and two 540-kW 500-volt generators with a 50-kW auxiliary generator. The cutter is driven by a 250-h.p. motor. There is a 75-h.p. motor for the forward swing drive hoist, a 45-h.p. motor, each, for the forward ladder hoist and the stern hoist, and a 60-kW generator for lighting and auxiliary power.

The dredging pump is of the high-speed, square, volute-lined centrifugal type developed by the Port of Portland, having 30-in. suction and discharge openings. The main pump motor is a 2,700-h.p. machine directly connected to the pump, and it is the largest of its kind ever built for dredging.

The *Clackamas* has proved its superiority over steam equipment of the same general type. In three calendar days, the new dredge handled 43,700 cubic yards through a discharge pipe 7,590 ft. long, moving sand, clay, gravel and sticks with a terminal lift of 29.3 ft. The average discharge for the three days was 797 cubic yards per hour. This was done without the aid of an electric booster.

Synchronous Electric Motors.

The Production of Constant Synchronising Torque.

IN a paper printed in the I.E.E. *Journal*, by Mr. Valère A. Fynn, dealing with new methods of improving the synchronising torque and weight efficiency of self-excited synchronous induction motors, polyphase self-excited synchronous induction motors are analysed with special reference to weight efficiency, conversion efficiency, and configuration of synchronising torque. It is shown that the weight efficiency of such machines is low compared with that of polyphase asynchronous motors, because the secondary must be designed to carry polyphase load currents as well as unidirectional load and exciting currents. The alternating currents must be carried in a polyphase winding, and the unidirectional currents in a single-phase winding. Although the latter may be a part of the former, it nevertheless follows that it is practically impossible to make the maximum synchronous torque of a given frame equal to the maximum asynchronous torque of the same frame. It is further pointed out that, even with a unidirectional and pulsating synchronising torque, such motors do not run asynchronously with a sufficiently uniform peripheral speed of the revolving member to permit of the general utilisation of their asynchronous overload capacity.

Having solved the problem of synchronising and compounding, the author addresses himself to the problem of increasing the weight efficiency. The solution of the problem amounts to producing two unidirectional and pulsating torques and displacing them by a quarter period, or producing three such torques and displacing them by one-third of a period, and so on. Broadly speaking, it amounts to producing a polyphase synchronising torque. One way of producing a constant synchronising torque in a polyphase synchronous induction motor is shown in the accompanying illustration.

In this novel arrangement the secondary A is in conductive connection with the brushes 9 and 10, but the connection between the secondary B and the brushes 7 and 8 is inductive, being accomplished by means of the static transformer 39, one winding of which is connected to the brushes 7 and 8, whilst the other is connected to the secondary winding. At synchronism the inductive connection between B and the brushes 7 and 8 is quite inactive, because the brush pressures are unidirectional, and the compounding characteristic of the motor is determined by the secondary A and the displacement angle. Upon departure from synchronism the inductive connection between 3 and the brushes 7 and 8 becomes active, and the machine exhibits a constant synchronising torque. The motor, it is claimed, starts with a higher torque per ampere than the ordinary asynchronous motor, operates synchronously and with a high power factor on all normal loads from zero to a little beyond full load, and operates non-synchronously on all overloads, but without the least irregularity of speed or any kind of periodic variation or oscillation of the peripheral velocity of the revolving member. As a result, the weight efficiency of the machine is considerably greater than that of any other synchronous induction motor, and its range of utility is also much greater.

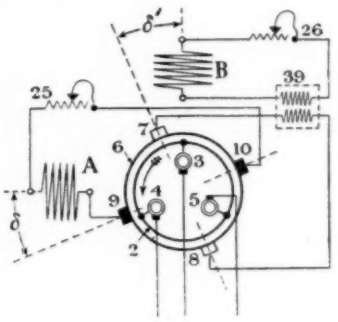

Diagram of Connections.

While all the motors designed by the author for constant synchronising torque have revolving primaries, identical results are obtained by placing the primary on the stationary member and revolving the brushes with the rotor. The several means adopted for rendering the second component of the synchronising torque effective at the proper time are applicable to separately-excited, as well as to self-excited, synchronous induction motors.

Legal.

Fame Electric Co. v. Cave.

ON July 14th, at the Bow County Court, before Judge Snagge, The Fame Electric Company, High Street, Stratford, E., sued Mr. A. Cave, formerly of Sheffield, and now of Southey, near Sheffield, an iron merchant and electrical agent, to recover £7 10s.

Mr. BATCHELOR, on behalf of the plaintiffs, said that the defendant did not appear, and did not answer when the case was called on in the Registrar's Court. They were asking for the return of an insulation testing set or its value £7 10s. The defendant was a sales agent for the plaintiff firm, but his engagement had been terminated.

The Judge ordered the return of the machine within 14 days, or, alternatively, judgment for £7 10s. and costs.

British Patents in the Irish Free State.

THE Dublin correspondent of *The Times* says that, according to a judgment delivered by Mr. Justice Meredith in the Dublin High Court on July 16th, no patent issued before December, 1922, is valid in the Irish Free State. The case was an action by the British Thomson-Houston Company, Ltd., against Litton & Co., a Dublin firm of electricians, for an interlocutory injunction to restrain the defendants from manufacturing or selling articles made in infringement of the plaintiffs' letters patent. The JUDGE said that letters patent under the seal of the British Patent Office could not apply to the Free State. If the privileges of the Patent Act were to have been preserved in the Free State Constitution they should have been preserved explicitly, like certain other private interests, by Article XI. The application of British patents to the Free State in the circumstances would be incompatible with the constitutional status of the country. The preparation of an appropriate Patent and Designs Act, as well as a Copyright Act, would occupy a certain period of time, but he understood that that task was part of the work of nation-building actually in progress. "As I hold that the letters patent of the plaintiff company do not extend to Saorstat Eireann," concluded his Lordship, "I must dismiss the action with costs." He refused, however, to dismiss the main action, which will be heard later.

Greenock Corporation's Powers Defined.

IN the First Division of the Court of Session, Edinburgh, before the Lord President, and Lords Sands, Blackburn, and Ashmore, on July 16th, there was disposed of a special case presented for Hurry Brothers, Greenock, and six other firms engaged in the

trade of electrical contractors in Greenock, the first party, and the Corporation of Greenock, the second party. The opinion of the Court was sought with regard to questions which had arisen as to whether the Corporation was, under the statutory provisions which regulated its powers in relation to the supply of electricity, authorised and entitled to engage in certain transactions.

The Division held that the Corporation was entitled in virtue of the statutory provisions to carry out installation work by supplying and installing for consumers, within its area of supply, main switches, fuses, wiring, branch switches, and lighting fittings; that it was not entitled to carry out such work upon terms whereby it stipulated for receiving payment therefor apart from hire, either by way of an immediate cash payment, or by way of instalment payments payable within the period of five years from the date of installation or supply; that it was not entitled to sell in and from its showrooms electric radiators, cookers, irons, motors, lamps, and other accessories, to persons residing either in the Corporation's area of supply or beyond that area; and that the Corporation was not entitled to undertake and execute for consumers within the area of supply in return for cash payments repairs to electrical installations and fittings other than installations and fittings provided, let, or hired by it in the exercise of the powers conferred by Section 23 of the Electricity Supply Act of 1919. The first party was awarded expenses.

Rose v. Siemens Bros. & Co., Ltd.

MR. JUSTICE RUSSELL, in the Chancery Division, on July 14th, commenced the hearing of an action brought by Mr. Henry Rose, of Blackheath, against Siemens Bros. & Co., Ltd., for an account of the commission he alleged to be due to him from the defendants under an agreement dated February 29th, 1924.

Mr. KENNEDY, K.C., for the plaintiff, said his client was in Egypt for some months in 1922, and associated himself strongly with Zaghlul Pasha and the Nationalist Party, so that eventually in December, 1924, on account of his proclaimed sympathy, he was deported from Egypt under an order of the new Government formed after the murder of the Sirdar. In 1924 the plaintiff was in London, and on February 4th went with the two sons of Izzet Pasha, the Egyptian Minister in London, to see the works of the defendants at Woolwich. They were conducted over the works and the plaintiff requested to be provided with particulars of their automatic telephones in order that he might interest the Egyptian Government in them. The result was the agreement of February, 1924, under which the defendants agreed to pay the plaintiff a commission of 2 per cent. on the invoice value of telephone exchange equipments supplied by the defendants to the Egyptian Government after that date. The plaintiff went to Egypt and in March, 1924, saw the Minister of Communications and other members of the then Egyptian Government, with the result that he obtained one or more valuable contracts. The defendants now said that they had been induced to enter into the agreement by the representation of the plaintiff that he was in a position to render them material assistance in the development of their telephone business in Egypt and that that representation was false, and they afterwards repudiated the agreement by a letter dated April 28th, 1924. They admitted getting an order for telephone equipment from the Egyptian Government, but denied that the plaintiff had anything to do with the procuring of it.

The plaintiff gave evidence in support of his case, at the conclusion of which Mr. MAYNE, Inspector-General of Railways, Telegraphs and Telephones, was called for the defence. He said he was in supreme command of telegraphs and telephones, and the only technical adviser to the Egyptian Government respecting them. The practice was that every contract, with few exceptions of small details, was put up to public tender. Automatic telephones had been studied by his department since 1921. He at last succeeded in getting the Egyptian Government to install the system. It was on his suggestion that the specification of the 2,000 lines was brought about. It was printed on April 24th, 1924, but the matter had been studied for months before, and was largely ready for putting into operation.

On July 15th, Mr. MAYNE, continuing his evidence, said that the consent of the Minister of Communications to the defendants' tender was given some time before the end of April, 1924. He had never heard of the plaintiff from any Egyptian Government official. The tender of the defendants was the second cheapest—their samples were excellent, and on that ground, and on that ground only, he strongly recommended that they should be given the order. Efficiency and price were the only things considered in his department in giving out contracts. Personal considerations never affected the matter.

At the conclusion of the arguments, Mr. Justice RUSSELL, in delivering judgment, having stated the facts, said that for the plaintiff to earn his commission it was necessary, first, that a contract for the supply of telephone exchange equipment should be entered into by the defendants; and, secondly, that the plaintiff must have rendered the defendants material assistance in the development of their telephone business in Egypt. He (the judge) was not entitled to read into the contract the words which would introduce a third condition—namely, that the contract should have been obtained directly by the plaintiff. Having referred to the evidence, his Lordship said it was difficult to imagine what services the defendants expected the plaintiff to render if it were not those he actually had rendered. The defence set up was that the plaintiff fraudulently represented to the defendants that he was in a position to render them material assistance and so induced them to enter into the agreement. There was no foundation for a charge of fraud. The charge was made recklessly by the defendants as one means of evading the contract into which they had entered. After getting from the plaintiff what they bargained for, the defendants had left no device unexplored to resist a just claim. There would be a declaration that the plaintiff was entitled to the commission claimed, and an order for an account on the footing of that declaration, and the defendants must pay the plaintiff's costs. On the application of Mr. G. B. Hurst, K.C., his Lordship said he would stay the account if the defendants paid £1,000 into Court within a week and gave notice of appeal before the end of the present sitting.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Charing Cross Bridge.—On July 12th, Colonel ASHLEY informed Mr. Barclay-Harvey that Charing Cross Bridge had not been strengthened since the war. He was informed by the Southern Railway Company that locomotives up to 140 tons weight might pass over the western portion of the bridge, and that upon the eastern, or original, portion the weight was limited to 96 tons, but that under the electrified working now in operation the latter portion would be traversed by electric stock, the loads of which were considerably less than locomotive loads.

Post Office Estimates.—On July 14th, Sir. WM. MITCHELL-THOMSON, the Postmaster-General, presented the Post Office Estimates He said that they showed a net increase of over £2,000,000 on those of last year, due to the development of the telephone system and the normal growth of Post Office work. The telephone service continued to make steady progress, and in the current year he anticipated a surplus of £250,000. The Post Office Tube, he thought, would be finished next month, and he hoped to bring it into service early next year. It had cost £1,680,000, and he did not see how it could produce economies which would pay the interest charges on that sum. This year he was estimating capital expenditure on telephones amounting to £11,720,000, divided as follows:—Trunks and submarine cables, £2,412,000; local exchange systems, £8,308,000; sites and buildings, £1,000,000. During the past year there had been an unprecedented growth in the number of new telephone stations—a net increase of 116,353 stations, representing a growth of 9.1 per cent. The number of effective cables showed an increase over the previous year of 9.4 per cent., and the trunk-line system was being rapidly developed. The Anglo-Continental branch of the telephone service now had 21 circuits, and it was anticipated that a full Anglo-German telephone service would be opened during the present summer. Automatic exchanges were being opened continuously in London. The number of rural telephone exchanges was now 709. Seventy-nine rural exchanges were in progress of construction. The loss on rural exchanges was something over £50 per exchange. With regard to broadcasting, the number of licences actually in force was 2,076,000, compared with 1,387,000 in force a year ago. As to the future of broadcasting, the Government proposed to accept the recommendations of the Crawford Committee, and on December 31st the service of the British Broadcasting Company would pass over to the control of a public corporation. There would be no interruption in the continuity of service and the licence fee would be maintained at 10s. The Government proposed to form an incorporated body, to hold a licence from the Postmaster-General to conduct the service. The actual regulation of the finance of that body would have to be done by the House of Commons. Turning to Imperial wireless services, he said that the Post Office had opened the wireless station at Rugby. Wireless telephonic communication across the Atlantic was established on February 7th. The problem of connecting the radio-telephonic service with the land trunk service appeared to have been solved. The completion of the "beam" system by the Marconi Company under the contract of 1924 had unfortunately been delayed through causes beyond the control of the contractors, but the stations at Bodmin and Bridgwater, for communication with Canada and South Africa, were now practically finished. Some time would be taken for completing the final adjustments, but he was informed by the Marconi Company that it hoped to commence preliminary tests from Bodmin with the Canadian station at the end of that week, and to be ready for the Post Office to make the official tests towards the end of the present month. The station for South Africa would be completed about mid-August. The stations at Grimsby and Skegness, for communication with Australia and India, would probably be ready in October. It was a reasonable expectation that the four beam stations would be in full operation before the end of the year.

Radio Wavelengths.—On July 14th, in reply to Sir H. BRITTAIN, Sir W. Mitchell-Thomson said that the British Broadcasting Company had recently been authorised to make certain alterations in the wave-lengths of several of its stations to meet the changing conditions caused by the extension of

broadcasting in neighbouring countries. It had also been given authority to conduct certain experiments, but no material alteration in its system of stations had yet been decided upon.

Wireless Licence Fees.—In reply to a further question by Sir H. BRITTAIN, Sir W. Mitchell-Thomson said that the whole of the revenue from wireless licence fees was paid into the Exchequer. The sum payable to the British Broadcasting Company was provided by Parliament and was charged upon the Post Office Vote, which also bore the cost of the issue and renewal of licences, the detection and prosecution of defaulters and general administrative control and accounting.

Mutilated Wireless Messages.—On July 13th, Sir W. MITCHELL-THOMSON informed Sir W. de Frece that he understood that the reception of British official news messages broadcast from Rugby was subject to serious interference at Penang (F.M.S.), not only from atmospherics but also from neighbouring high-power stations at Saigon, in French Indo-China, and Malabar, in Java. He was advised that that interference could be much reduced by the use of receiving apparatus of a different type, particulars of which had already been sent to the Postmaster-General of the Straits Settlements. Arrangements had recently been made to increase the power of the transmissions from Rugby, and this increase, coupled with the use of more suitable receiving apparatus, would, it was hoped, enable the official news messages to be received satisfactorily at Penang.

Finance Bill.—On July 16th, during the report stage of the Finance Bill, Col. ASHLEY, the Minister of Transport, moved an amendment, which was agreed to, to reduce the new duties on electrically-propelled vehicles by 50 per cent.

Private Bill.—In the House of Lords the London Electric and Metropolitan District Railway Companies' Bill has been read the third time.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from July 14th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

R.T. (lettering and design). No. 465,311. All goods in Class 8.—La Société La Radiotechnique, Paris. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Radion. No. 469,778. Class 8. Thermionic valves.—Radions, Ltd., Bollington, Cheshire.

Four Yellow Stripes (design only). No. 469,855. Class 8. Electric cables having braided covers.—Calkender's Cable & Construction Co., Ltd.

Bremaco. No. 470,006. Class 8. Electric batteries.—Bremner, Olfen and MacKay, 30, Great Clyde Street, Glasgow.

Britimax. No. 470,570. All goods in Class 8.—British General Manufacturing Co., Ltd., Tyrwhitt Road, Brockley, S.E.4

Fyglo. (No. 469,336.) Class 18. Electric fires and radiators.—Berry's Electric, Ltd.

Plastose No. 468,989. Class 50. Electric insulating material made from condensation products, phenol and formaldehyde, known as synthetic resin.—Société La Plastose, Niort (Deux Sevres), France. (L. Charbonnel, Finsbury House, Blomfield Street, E.C.2.)

Published Specifications.

Compiled expressly for this journal by Patent Agents

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

70. "Electrolysis." M. A. Adam. January 1st, 1925. (253,958.)

4,951. "Fusible electrodes for electric arc-welding." Cape Asbestos Co., Ltd., and J. Gow. February 23rd, 1925. (253,965.)

6,739. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) and J. R. Gould. March 12th, 1925. (253,972.)

7,139. "Electric hand-irons and other electrically-heated appliances." P. H. H. Bailey. March 17th, 1925. (253,974.)

7,212. "Electrical signalling and controlling systems." Metropolitan-Vickers Electrical Co., Ltd. March 17th, 1924. (230,867.)

7,633. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. March 20th, 1925. (Cognate application 13,534/25.) (Addition to 238,477.) (253,986.)

7,729. "Electric fuses." V. Hope. March 23rd, 1925. (253,987.)

7,928. "Electric controlling apparatus." Sullivan Machinery Co. October 31st, 1924. (242,220.)

7,949. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) and A. M. Searle. March 24th, 1925. (254,000.)

8,002. "Automatic telephone exchange systems." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.) and A. M. Searle. March 25th, 1925. (254,002.)

8,003. "Telephone systems." Standard Telephones and Cables, Ltd., and J. H. E. Baker. March 25th, 1925. (254,003.)

8,037. "Magneto generators." British Thomson-Houston Co., Ltd., L. Griffiths, and T. Woodfield. March 25th, 1925. (254,005.)

8,221. "Sound amplifiers or loud speakers." R. W. Edmonds and Webb's Crystal Glass Co., Ltd. March 27th, 1925. (Addition to 246,923.) (254,016.)

8,717. "Electric liquid heaters." H. Wintle. April 1st, 1925. (254,028.)

8,892. "Electromagnetic separators for the separation or concentration of minerals." M. Koizumi. April 3rd, 1925. (254,030.)

8,946. "Telephone receiver." De Forest Phonofilms, Ltd. (L. de Forest). April 3rd, 1925. (254,032.)

9,157. "Intermittent inductive train-control system." W. K. Howe. April 6th, 1925. (254,035.)

9,288. "Frame aerials and the like." P. W. Willans. April 7th, 1925. (254,036.)

9,733. "Automatic telephones." International Electric Co., Ltd., and F. R. Baldock. April 14th, 1925. (254,043.)

10,074. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), H. J. Herinck, A. M. Searle, and J. H. E. Baker. April 17th, 1925. (254,045.)

10,075. "Automatic and semi-automatic telephony." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.), R. A. Moir, and G. C. Hartley. April 17th, 1925. (Cognate application 11,438/25.) (254,046.)

12,070. "Electric accumulators." W. H. Allcock. May 9th, 1925. (254,053.)

12,458. "Electric measuring instruments." F. Holden and Measurement, Ltd. May 13th, 1925. (254,060.)

12,970. "Electric heaters or radiators." J. Stone & Co., Ltd., and A. E. Honey. May 18th, 1925. (254,063.)

13,490. "Process and apparatus for the electrodeposition of metals on wire or narrow strip." J. A. Parker. May 23rd, 1925. (254,067.)

13,514. "Loaded telephone and like lines." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). August 14th, 1924. (238,512.)

14,686. "Ferraris electric meters." Soc. Genevoise d'Instrument de Physique. October 6th, 1924. (240,790.)

15,133. "Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., and W. G. Patterson. June 10th, 1925. (254,087.)

15,292. "Telephone receivers or transmitters." British Thomson-Houston Co., Ltd., and C. J. Morton. June 12th, 1925. (254,088.)

15,728. "Mouthpieces or trumpets for telephonic transmitting and receiving apparatus." E. A. Graham. June 17th, 1925. (Addition to 191,801.) (254,092.)

16,077. "Portable electric lamps." H. M. Selson and L. B. Castello (executors of R. H. Nash, deceased). June 22nd, 1925. (254,095.)

16,141. "Rolling contact for electrical apparatus." Vickers, Ltd., E. C. Astington, and E. T. Flann. June 22nd, 1925. (254,098.)

17,368. "Electrical installations comprising current modifiers." M. Doloukhanoff. July 7th, 1924. (236,597.)

18,021. "Cord grips for electric fittings and appliances." W. V. Butterfield and Mycromet Manufacturing Co. July 14th, 1925. (Cognate application 28,066/25.) (254,112.)

18,631. "Inductance-coil holders." H. G. White, L. F. Bennett, and C. A. Vandervell & Co., Ltd. July 22nd, 1925. (254,114.)

18,914. "Telephone systems." J. E. Pollak (Siemens & Halske Akt. Ges.). July 24th, 1925. (254,116.)

19,892. "Method and device for adjusting and testing stroboscopically electric meters." R. N. Fichter. August 7th, 1925. (254,123.)

20,405. "Inductance coils." D. R. Lovejoy. August 14th, 1925. (238,560.)

20,810. "Electric transformer." F. B. Dehn (Products Protection Corporation). August 19th, 1925. (254,133.)

21,772. "Method of and means for preventing discharges from surfaces or bodies charged to a high electrical potential." D. M. Simons. August 31st, 1925. (254,137.)

23,523. "Radio tuning apparatus." M. R. Cahill. September 21st, 1925. (254,147.)

23,637. "Apparatus for the regenerative control of electric motors." G. Somajni. September 23rd 1924. (240,457.)

26,707. "Electrolytic decomposition of alkali metal chloride solutions." Konigsberger Zellstoff-Fabriken und Chemische Werke Koholyt Akt. Ges., and Dr. E. Schlumberger. October 24th, 1925. (254,163.)

26,744. "Electrical testing devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Bell Telephone Laboratories, Inc.). October 26th, 1925. (254,164.)

28,072. "Electromagnetic cut-outs." Stotz Ges. Abteilung der Brown, Boveri et Cie. Akt. Ges. November 8th, 1924. (242,664.)

30,769. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd., and L. P. Lowry. December 5th, 1925. (254,183.)

31,530. "Electrodes for use in electrolytic systems for protecting boilers and the like." A. Kirkaldy. December 14th, 1925. (254,188.)

32,560. "Means for supplying electrical power to moving vehicles." M. Devos. December 24th, 1924. (245,156.)

32,612. "Junction-boxes or coil casings for submarine cables." Felten and Guilleaume Carlswerk Akt. Ges. December 27th, 1924. (245,160.)

32,763. "Solenoids or inductance coils." W. A. Appleton and J. Joseph. December 28th, 1925. (254,203.)

32,768. "Process for producing amino-oxy compounds of the aromatic series by electrolysis." H. E. Potts (Chemische Fabrik Gouvan Landshof & Meyer Akt. Ges.). December 29th, 1925. (254,204.)

1926.

1,911. "Radiating structures for high-frequency electric signalling." Westinghouse Electric & Manufacturing Co., Ltd. January 24th, 1925. (246,496.)

2,918. "Lead-in wires for electric lamps and the like, and method of making the same." Metal & Thermit Corporation. March 10th, 1925. (249,084.)

8,280. "Apparatus for testing the viscosity of fusible materials." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric & Manufacturing Co.). March 26th, 1926. (254,239.)

8,872. "Electric motor controllers." British Thomson-Houston Co., Ltd. April 1st, 1925. (250,259.)

9,889. "Variable electric condensers." G. J. Mahieu. April 15th, 1925. (250,952.)

The Whitworth Society.—The third summer meeting of the above Society was held in Manchester on June 14th, when visits were made to the works of Messrs. Mirrlees, Bickerton and Day, at Stockport, and to the Openshaw Works of Sir W. G. Armstrong, Whitworth & Co., Ltd. In the evening, the president, Mr. Wm. Sisson, welcomed the members to dinner at the Engineers' Club. The address of Dr. F. P. Purvis, the president-elect, who was unable to be present through ill-health, was read from the chair.